



# CHEMICAL ABSTRACTS

Vol. 15.

JULY 20, 1921

No. 14

## 1—APPARATUS

C. G. DERJCK

**Automatic potential regulator for research on vacuum discharge.** A. RÜTTENAUER. *Z. tech. Physik.* 2, 71-3(1921).—Description, with sketch, of app. for regulating potential during vacuum discharge. It does not lend itself well to abstracting.

E. H. DARBY

**Modifications of the adiabatic calorimeter.** W. SWIENTOSLAWSKI. *J. Am. Chem. Soc.* 43, 875-6(1921).—The cover to the submarine inclosure is made tight by a vaseline or paraffin seal. The jacket temp. is changed by hot or cold water, blown in by means of air, which also furnishes the stirring. The difference of calorimeter and jacket temp. may be on the av. about  $0.3^{\circ}$  for a minute, so the regulation is relatively crude.

W. P. WHITE

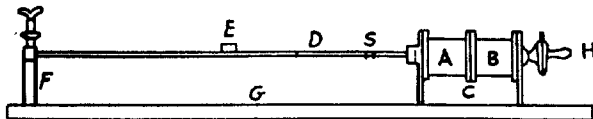
**Apparatus for determining the fluidity of oils at low temperatures.** ANON. *Giorn. chim. ind. applicata* 2, 388-90(1920).—The app. described is essentially a device for production and regulation of low temps. by the expansion of liquid  $\text{CO}_2$ . An illustration and sketches are given together with detailed description. The app. may also be used for experimentation upon substances other than oils, where surroundings of low temps. are required.

ROBERT S. POSMONTIER

**Apparatus for registering the variations in gas volume with temperature.** A. A. GUNTZ. *Compt. rend.* 172, 918-20(1921).—Description of an app. for measuring vol. changes of a gas. The gas container is placed in a water bath and connected with a manometer. A nichrome wire dips into one arm of the manometer. Its elec. resistance varies with the length exposed. A current passing through the wire is measured by a galvanometer. This makes possible a photographic record of the change.

E. H. DARBY

**A simple permeability tester for gas meter and other membranes.** ROBERT MEZGER. Stuttgart. *Chem. Ztg.* 45, 374-5(1921).—*A* and *B* are pipes 80 mm. long with flanges welded on each end; *D* is a graduated glass tube 700 mm. long, 4 mm. inside diam., supported at the outer end by a micrometer screw *F* for leveling it; *E* is a sliding level; *H* is a cock and nipple for introducing gas into *B*; *G* is a wooden base. *D* fits into a stopper in a hole 15 mm. diam. in the head of *A*, the inner end of the hole having a



shoulder against which the stopper is pushed each time. To operate, a column of colored soln. *S* about 2 cm. long is introduced into the end of *D* next to *A*. *D* is inserted into *A* and leveled by means of *F*. A disk of the membrane to be tested is inserted between the flanges *C*, with good packing rings on each side. The vols. of *A* and of that portion of *D* between *S* and *A* are calcd. to  $0^{\circ}$  and 760 mm., and the gas is admitted to *B* through *H*. The pressure on the membrane causes *S* to jump forward a

few cm., and as soon as equil. is restored its position is again read and the difference ( $\alpha$ ) between the 2 readings noted. At the end of the test the position of  $S$  is again read, ( $\alpha$ ) subtracted from it and the volumes of  $A$  and  $D$  are calcd. to  $0^\circ$  and 760 mm., as before. The increase is the vol. of gas diffused through the membrane during the time of the test.

J. H. MOORE

A note on a special slide rule for calculation of "wet" and "dry" weights of damp materials. R. SCORR. *J. Soc. Chem. Ind.* 40, 96T(1921).—A simple slide rule has the frame scale divided in the usual logarithmic manner and the slide scale divided proportionately to  $\log 100/(100 - M)$  between suitable limits of  $M$ . The calcn. is based on the formula:  $D \times 100/(100 - M) = W$ , where  $D$  = "dry" wt.,  $W$  = "wet" wt., and  $M$  = moisture. The frame scale extends beyond the 100 point by a length equal to the total length of the slide scale. For the "wet" wt. detn. the zero mark on the slide scale is placed opposite the division on the frame scale corresponding to the "dry" wt. and the "wet" wt. read off opposite the moisture content. For "dry" wt. detn. the process is reversed. The max. error, due to accumulation of errors in the same direction, is 0.56 lb. (254 g.) per 100 lbs. (45.56 kg.) of dry material. The slide scale was designed for use on nitrocellulose batches, but in general a similar instrument should be useful for all calcs. of the type  $a = x f(y)$  with the slide scale divided in proportion to the  $\log f(y)$ . By the use of several slides equations of the type  $(a) = F(x)f(y)$  may be solved by dividing the frame scale proportional to  $\log(a)$  and the slide scale proportional to  $\log F(x)$  and  $\log f(y)$ .

W. H. BOYNTON

Aids for exact reading of burets. G. BRUHNS. *Charlottenburg. Chem. Ztg.* 45, 337-8(1921).—A discussion of well known principles and errors in reading burets. Suggested aids are: (1) A glass tube open at both ends and with a ring mark near each end. These marks must be fine and lie in planes perpendicular to the axis of the tube. The tube is just large enough to slip over the buret and move freely up and down. (2) A water level in the form of a U tube suspended beside the buret to show the proper level for the eye in reading. For colored solns. the rim of the liquid instead of the bottom of the meniscus may be read.

J. J. MORGAN

A simple instrument for the determination of the refractive indices of liquids. W. A. M. SMART AND F. A. HOCKING. *London. Pharm. J.* [4] 52, 286-8(1921).—The end of a hatpin set horizontally in a slide is raised or lowered on a vertical support by rack and pinion to the position at which it exactly coincides with its image, reflected by a mirror set beneath it in a base flush with the surface. A lens on the slide above the pin enables this point to be detd. with accuracy. A reading is made with a biconvex lens, 1.375 in. in diam., + 6 to + 10  $D$ , resting on the mirror with its center beneath the point of the pin; a mm. scale on the vertical support, with its 0 coincident with the center of the lens, gives the focal length  $F$ . A reading  $F_1$  is taken with water between the lens and the mirror forming a plano-concave lens, and a third reading  $F_2$  is made with the liquid to be tested in place of the water. If  $n$  is the refractive index of an oil, and  $n_w$  that of water,  $(nw^{-1})/(n^{-1}) = [(1/F_1) - (1/F)] / [(1/F_2) - (1/F)]$ . Directions are given for the calibration of the instrument. Detns. can be made with accuracy at ordinary temps., but at higher temps., as e.g.  $40^\circ$  for castor oil, the results are less satisfactory, although they may be improved by previously heating the mirror to about the desired temp.

F. F. HEYROTH

Temperature control in power houses. G. KEINATH. *Elektrotechn. Z.* 42, 459-63 (1921).—Practical illustrations of the application of pyrometers in steam and elec. plants.

C. G. F.

Further Laue methods. R. CROSS. *Hamburg. Centr. Mineral. Geol.* 1920, 52-64.—G. describes an instrument for the measurement of Laue photograms, an app. for the röntgenometric det. of single, very small, crystallographically unmountable objects; and gives directions for the detn. of symmetry elements.

W. F. FOSHAG

A new astigmatic polarization prism for use as an analyzer in the polarizing microscope. ARTHUR EHRLINGHAUS. *Göttingen. Centr. Mineral. Geol.* 1920, 175-82. —Two types of prisms are described. In one the astigmatism is corrected by grinding the top of the prism convex and the bottom concave; in the second the bottom is ground concave, the top plane, and a crown and flint glass doublet inserted over the prism.

W. F. FOSHAG

A simple optical pyrometer. H. LUX. *Elektrotechn. Z.* 42, 494-5 (1921); *Gas. u. Wasserfach* 64, 374-5. —The principle: the brightness of the filament of an incandescent lamp is adjusted by varying the resistance in series, until it matches the brightness of the furnace, flame or other temp. source under investigation. Lux suggests a simplification of the standard Lummer-Kurlbaum pyrometer, thereby reducing the first cost appreciably. He uses an old camera and permits the image of the bright spot together with that of the filament to be focused on the ground glass of the camera. A milliammeter and a slide resistance complete the outfit. Full details are given. Operating range, 600° to 2100°.

C. G. F.

Automatic electric water heater. ANON. *J. Elec. Western Ind.* 46, 587 (1921). —The 600-watt size requires one hr. to heat the three gallon tank of water from 16° to 60°. The cost of maintaining the temp. constantly at 60° against loss by radiation amounts to \$0.015 per hr. with current at \$0.15 per hr. The improved type of heating unit permits the water in the tank to circulate freely and thus to maintain an even temp. from top to bottom. The temp. regulator works without relays or contactors. There is also a 1000-watt size.

C. G. F.

The compartment dryer (CARRIER, STACEY) 13.

## 2—GENERAL AND PHYSICAL CHEMISTRY

W. E. HENDERSON AND EDWARD MACK

William Odling. J. E. MARSH. *J. Chem. Soc.* 119, 553-64 (1921). —An obituary. E. J. C.

Atomic weight of germanium. JOHN H. MÜLLER. *J. Am. Chem. Soc.* 43, 1085-95 (1921). —The conversion of K fluogermanate to KCl furnishes a convenient method. Ge oxide was prepd. from a Ge-bearing zinc oxide by soln. in HCl. pptn. as sulfide and distn. as oxide after treatment with HNO<sub>3</sub>. The Ge oxide was dissolved in HF and the double salt was pptd. by adding slightly more than the calcd. wt. of K<sub>2</sub>CO<sub>3</sub>. The mean of 7 detns. gave 72.42 as the at. wt. of Ge.

E. D. WILLIAMSON

Revision of the atomic weight of lanthanum. Analysis of lanthanum chloride. GREGORY P. BAXTER, MUNEO TANI AND HAROLD C. CHAPIN. *J. Am. Chem. Soc.* 43, 1080-5 (1921). —The double ammonium lanthanum nitrate was purified carefully by over a thousand cristallizations. The spectrum of the final material showed no trace of Pr. La oxalate was pptd., ignited, and finally converted to chloride. Water of cristallization was removed slowly and the salt was then rapidly fused. The ordinary silver nitrate analysis was used. The results for the at. wt. vary from 138.880 to 138.969, the averages of two series being 138.914 and 138.912.

E. D. WILLIAMSON

Numerical revision of the results concerning the density of methyl fluoride. The atomic weight of fluorine. E. MOLES AND T. BATURCAS. *J. chim. phys.* 18, 353-58 (1920). —After the introduction of corrections for the value of the gravitational const. due to latitude and altitude, and further refinements in the observations upon the density of MeF and the at. wt. of F (cf. *C. A.* 14, 1466), the mol. wt. of MeF is established at 34.025. From this the at. wt. of fluorine is calcd. to be 19.002, with a max. possible error of observation of  $\pm 0.004$ . From these considerations there seems to be

no valid reason for retaining the value 19.0 in the International Table of Atomic Weights, as the value 19.00 has been definitely established by several observers.

J. T. R. ANDREWS

**Internal friction of cobalt in a variable magnetic field.** E. DRAGO. *Atti accad. Lincei* 28, II, 351-4, 434-8(1919); *Science Abstracts* 23A, 474-5.—The internal friction of a Co wire always increases in a variable magnetic field, the contrary of that which takes place in the case of wires of Fe and Ni. Under the exptl. conditions described it appears that the greatest increases are attained with the intermittent magnetization produced by the oscillatory discharges set up at the beginning and end of each simple oscillation of the wire. Corresponding to such increase of internal friction there is produced a temporary deformation of torsion of the Co wire under the action of the oscillatory discharge.

H. G.

**Magnetic variation of resistance of bismuth.** O. M. CORBINO. *Atti accad. Lincei* 28, I, 49-57(1920); *Science Abstracts* 23A, 475.—A treatment of the theory of the variations of the resistance and of the Hall effect with increase of magnetic field in the case of metals such as Bi. Cf. Corbino and Trabacchi (*Nuovo cimento* 9, 118-22 (1915); cf. C. A. 9, 2835) and Corbino (*Nuovo cimento* 16, 185-96(1918)).

H. G.

**Relation between Hall-effect and Corbino-effect for bismuth.** G. C. TRABACCHI. *Atti accad. Lincei* 28, II, 276-81(1919); *Science Abstracts* 23A, 475.—Describes expts. on the effect of temp. on the Hall effect and Corbino effect (cf. preceding abst.) in the case of Bi, and shows that  $E/Rc$  is a const., where  $E$  is a characteristic of the metal,  $R$  the coeff. of the Hall effect, and  $c$  the cond.

H. G.

**Corbino effect in fused bismuth.** T. COLLODI. *Nuovo cimento* 19, 163-72(1920).—In Bi, the Corbino effect, in a field of average intensity, decreases rapidly with rise of temp., until it becomes finally zero (or the least value measurable by the app.) at the m. p., and remains const. at zero in the fused metal. The Corbino effect in relative values was as follows: at 15°, 24; 35°, 18; 55°, 14; 90°, 9.5; 128°, 5.5; 162°, 3.5; 205°, 2; 243°, 1; 270°, etc. 0.

ROBERT S. POSMONTIER

**The hardness of mixed crystals.** P. J. HOLMQUIST. *Geol. För. Förh.* 42, 393-412 (1920).—The examn. of garnets, tourmalines, blends, spinels and rutiles indicates that (1) pure simply formed crystals possess the greatest hardness; (2) the introduction of a softer substance which forms an isomorphous mixed crystal results in decreased hardness; (3) crystals which are microscopically or cryptomorphically mixed, and in general those showing mechanical mixt., are harder than their components. The hardness of a true mixed crystal lies between the hardnesses of its components; the occurrence of an intermediate max. hardness is indicative of a sepn. of the crystal components. [This is analogous to the action of steel (ferrite-cementite dispersion) which shows increasing hardness as the cementite grows towards visible sepn.]

JEROME ALEXANDER

**Measurement of high degrees of hardness.** J. INNES. *J. Inst. Mech. Eng.* 1920, 915-32.—The hardness ( $H$ ) of a material depends on the elastic properties, and the following formula is given as a means of detg. and measuring it:

$$H = (\pi^2/96) \cdot [(3 + 4N)^2(3 + N)] / N^3 \cdot (Q^2/C^2)$$

where  $N$  is the ratio of modulus of change of size to modulus of change of shape,  $C$  the modulus of change of shape, and  $Q$  the limiting shear stress. These three factors can readily be detd. separately, and if test pieces of moderate size (rods of 0.1 in. diam. and 3 in. long) are available, two of those constants,  $C$  and  $N$ , may be measured with almost any desired degree of accuracy.  $Q$  is more difficult to measure, especially with brittle materials.

J. S. C. I.

**Mechanical properties of plastic substances (steel, glass). Importance of reactivity.** H. AND F. LE CHATELIER. *Compt. rend.* 171, 695-9(1920).—From the results of torsion tests on glass at its temp. of annealing (540°), and on mild steel at its temp. of forging

(825°), it is shown that at a sufficiently high temp., and with small forces, plastic substances undergo successively three types of deformation: (1) An instantaneous elastic deformation which disappears immediately after the suppression of the force; (2) a subpermanent deformation, produced slowly and disappearing slowly after the suppression of the force, and having an order of magnitude comparable with that of the instantaneous deformation; (3) a viscous deformation continuing the subpermanent deformation; this is produced with a const. velocity and does not disappear after the suppression of the force. In the case of soft steels Coulomb's modulus of elasticity is probably a linear function of the temp.

J. S. C. I.

**The elasticity constants of crystallized potassium alum.** W. VOIGT. *Nachr. Kgl. Ges. Wiss. Göttingen, Math.-physik. Klasse* 1919, 85-99.—The pieces of alum used were cut from several large octahedral crystals. The best values of the principal moduli are  $s_{11} = 53.2 \times 10^{-10}$ ,  $s_{22} = -15.6 \times 10^{-10}$ ,  $s_{44} = 115.2 \times 10^{-10}$ . This shows that the elastic anisotropy of alum is comparatively slight. For an isotropic body  $2(s_{11} - s_{22}) = s_{44}$ .

R. S. DEAN

**Effect of temperature on resistance and specific resistance of tellurium crystals.** ARTHUR R. FORTSCH. *Proc. Iowa Acad. Sci.* 26, 523-6(1919).—The crystals, which were mounted by fusing Pt wires into the ends and placing the whole in evacuated glass tubes, were subjected to temps. varying from -79 to 280° and the resistances measured. The results, which are given graphically, show no max. resistance, and show a decrease of resistance with increased temp. Te does not obey the Wiedemann-Franz law and does not appear to have the properties of metals. G. W. STRATTON

**Some structural features of selenium deposited by condensation from the vapor state in the neighborhood of the melting point.** L. E. DODD. *Proc. Iowa Acad. Sci.* 26, 501-8(1919).—In the app. used for detg. the vapor pressure of Se (*C. A.* 14, 2736), the Se deposited on the inner condensation tube in the form of zones which were somewhat different in two series of expt. Time had no effect on the character of the deposit except in deepening it, but there was some increase in its total length with rising temp.

G. W. STRATTON

**The relation between the color of chemical compounds and the structure of their molecules.** JAKOB MEISENHEIMER. *Univ. Griefswald. Z. physik. Chem.* 97, 304-18 (1921).—The color of chem. compds. is discussed on the basis of Kossel's conception of mol. and at. structure (cf. *C. A.* 10, 2654). That the iodides of org. bases are frequently yellow and the corresponding chlorides and bromides colorless, is due to the fact that I, in contradistinction to the lighter halogens, while able to take up an 8th electron and form an iodide is not always able to draw this electron in sufficiently far so that its outer shell assumes the stable, inert-gas form. Under these conditions the 8 electrons move around the nucleus in an unstable course, from which they may be displaced by the energy of the vibrations of visible light. If this occurs the compd. must appear colored. A large number of other colored compds., both org. and inorg., are discussed.

H. JERMAIN CREIGHTON

**Some additive properties of organic salts.** MARÍA L. LECHE DE GARCÍA. Buenos Aires. *Anales soc. quim. Argentina* 8, 381-95(1920).—Valson (*Compt. rend.* 73, 441), Bender (*Wied. Ann.* 20, 560(1883)) and Bernaola (*Anales soc. quim. Argentina* 8, 35 (1920)) have demonstrated that for inorg. salts in soln. a law involving moduli can be formulated. D. of  $xN$  salt A soln. = d. of  $xN$   $NH_4Cl$  soln. +  $x$  times the sum of the moduli corresponding to the acid and basic radicals of salt A. This article deals with org. salts, giving data for the d. and index of refraction  $n$  of  $NH_4$ , Na, K, Ca, Ba, Zn, Mg and Sr salts of a no. of org. acids in solns. varying from 0.0625 to 4  $N$ . It is shown that the modulus law is subject to deviations which become greater as the no. of C atoms in the acid radical increases. The additive relation is shown to be more evident in the values for  $n$ . The chem. constitution reveals the additive relation very accurately

for  $N$  solns. of  $\text{HCOOH}$ ,  $\text{AcOH}$  and  $\text{EtOH}$ . Moduli for these radicals and for  $\text{NH}_4$ ,  $\text{Na}$ ,  $\text{K}$ ,  $\text{Ca}$ ,  $\text{Sr}$ ,  $\text{Ba}$ ,  $\text{Zn}$  and  $\text{Mg}$  are given, which are combined according to the formula  $n = K + 0.001 \times (\text{acid radical} + \text{basic radical})$  to give values for  $n$ , agreeing exactly with exptl. values. Comparing  $d$  with  $n$ , it was found that the sp. refractive power by Gladstone and Dale's formula increases as the concn. of all salt solns. with less than 33.1% of  $\text{C}$  decreases. The values for all other salts with a higher % of  $\text{C}$  decrease with the concn. Applying Newton and Laplace's formula, the values decrease with the concn. for all salts with over 30%  $\text{C}$ . For those with less than 30%, the values increase with the diln. With the formula of Lorenz and Lorentz the crit. % of  $\text{C}$  is 37.4. The sp. refractive power with the same acid radical increases as the basic radical becomes proportionally lighter than the acidic radical. In any series this power increases in an additive way relative to the increase in any  $\text{C}$  group. The  $\text{C}_6\text{H}_5$  nucleus has a greater sp. refractive power than a group of 6  $\text{C}$  atoms in an aliphatic compd. To show the influence of position, the value for  $\text{PhCOONa}$  is greater than for  $o$ - and  $p$ - $\text{MePhCOONa}$  and less than for  $m$ - $\text{MePhCOONa}$ . In general it is pointed out that although  $d$ , sp. vol.,  $n$ , sp. refractive power, mol. vol. and mol. refractive-power show an additive relation expressed by moduli, the chem. constitution is very important and always influences these values.

C. C. DAVIS

**The applicability of the Mendelyev rule to benzene and halobenzenes.** W. HERZ AND JULIUS MEYER. Univ. Breslau. *Z. physik. Chem.* 97, 381-7 (1921).—The conclusion is reached that Mendelyeff's equation for the sp. vol. of liquids,  $V_0 = V_1(1 - K)$ , holds for both normal and associated liquids and for liquid mixts., within the limits of accuracy of exptl. data. This conclusion is based upon a comparison of the calcd. and exptl. detd.  $d$  of  $\text{C}_6\text{H}_6$ ,  $\text{C}_6\text{H}_5\text{F}$ ,  $\text{C}_6\text{H}_5\text{Cl}$ ,  $\text{C}_6\text{H}_5\text{Br}$ ,  $\text{C}_6\text{H}_5\text{I}$  and various mixts. of these liquids for  $10^\circ$  intervals between  $20$  and  $70^\circ$ . It has been found that the  $K$  values for the different liquids vary irregularly about the mean value, this variation being due to exptl. errors. Since the percentage errors with normal and associated liquids may be of the same order of magnitude, this equation cannot be used to distinguish between these 2 classes of liquids, unless the accuracy of the  $d$  detns. be greatly increased.

H. JERMAIN CREIGHTON

**Some physico-chemical constants of acrylic acid.** CHARLES MOUREU AND A. BOUTARIC. *J. chim. phys.* 18, 348-52 (1920).—Acrylic acid was prepd. in a high degree of purity and the following consts. were detd.: m. p. =  $12.3^\circ$ ; b. p. =  $141.6^\circ$  under 752 mm.;  $48.5^\circ$  under 15 mm.;  $d_4^{25} = 1.0600$ ;  $d_4^{20} = 1.0511$ ;  $n_D^{20} = 1.4224$ . Mol. heat of neutralization, 13.85 Cal., shows acrylic acid to be a stronger acid than either formic or acetic acid. Heat of combination for 1 g. = 4554.5 Cal. Mol. heat of combination = 327.9 Cal., from which the heat of formation is computed to be 93 Cal. These consts. agree well with those found by Rüber and Schetelig in 1904. From the cond. of  $\text{Na}$  acrylate solns. the mobility of the  $\text{CH}_2=\text{CHCO}_2^-$  ion was found to be 34.9 mhos, which gives for the acid at infinite diln. the mol. cond. of 350 mhos at  $18^\circ$ . At the same temp.,  $18^\circ$ , the dissoc. const. of acrylic acid is shown to be  $K = 5.6 \times 10^{-4}$ , thus establishing it as very nearly of the same strength as that of phenylacetic acid.

J. T. R. ANDREWS

**Tables giving alcoholic strength from the specific gravity. II. 25-50% of alcohol by weight.** G. TOMMASI. *Ann. r. staz. chim. agrar. sper.* II, 9, 37-74 (1917-1919); cf. C. A. 9, 687.—Tables are given showing percentage of alc. by wt., percentage of alc. by vol. at  $15^\circ$ , and number of g. of alc. in 100 cc. at  $15^\circ$  for the sp. grs. of aq. alc. solns. detd. at a number of different temps. ranging from  $10^\circ/15^\circ$  to  $25^\circ/15^\circ$ .

J. S. C. I.

**Proof of the extension of Boltzmann's kinetic theory to the case of external forces depending upon molecular velocities. I, II.** G. POLVANI. *Nuovo cimento* 19, 173-82, 225-37 (1920).—Mathematical.

ROBERT S. FOSMONTIER

**Calculation of the migration velocity formula proposed by Langevin.** H. F. MAYER.

*Ann. Physik* 62, 358-70(1920); *Science Abstracts* 23A, 520-1.—M. first describes previous work on the migration velocities of particles forced through gases. The earliest investigation, which refers to a particle of any prescribed minuteness, and is based on the kinetic theory of gases, was made by Lenard [*Ann. Physik* 3, 298-319 (1900)], who evolved by simple means a general migration velocity formula for elec. carriers in gases. Two further publications appeared in 1913 and the most recent one in 1919 [cf. *C. A.* 14, 1892]. Opposed to Lenard's results are those obtained by Langevin in 1903 and 1906. The present investigation attempts to discover the source of the difference between the two theories. The main consideration which underlies both the work of Lenard and Langevin is as follows: A particle moving through a gas loses a definite amt. of its velocity at every impact with a gas mol. In the stationary state this velocity loss is just compensated by the velocity increase which the particle acquires from the external force during the time between two consecutive impacts. As a consequence, the velocity of the particle in its free path is not uniform but accelerated, a circumstance which is of great importance for the mathematical solution of the problem. Notwithstanding the identity of the basic ideas in both theories, there is a difference of attack in that Lenard studies the migration velocity directly, while Langevin approaches indirectly *via* the velocity of diffusion. M. points out the essential difference between these two velocities, in that for diffusion the motion of the particle along the free path is uniform, while the migration velocity is accelerated. This fact was not taken into account by Langevin, and constitutes one of the sources of difference between the two final results. The present paper is a mathematical exposition of this divergence.

H. G.

**Kinetic theory of osmotic pressure.** KARL F. HERZFELD. *Ann. Physik* 64, 646-60 (1921).—An explanation is given of the mechanism by which the solvent is driven into the soln. when they are sepd. by a semi-permeable membrane under equal pressure. The external pressure in a pure liquid is first considered, then, following G. Jäger, how these considerations apply to a soln. when no attractive forces exist between the solvent and solute. It is shown that the presence of such forces does not change the osmotic pressure. With no attractive force the kinetic pressure of the solute is exerted upon the free surface of the soln., while under a sufficiently great attraction the pressure is upon the capillary layer. It is this kinetic pressure of the solute which pushes away the surface and causes the solvent to penetrate the membrane. The internal pressure in a soln. is increased when attractive forces exist between the solvent and solute, but the values given by Tammann do not agree with those calcd. from the measured heats of hydration.

E. N. BUNTING

"A thermokinetic explanation of the mutual attraction of colloidal particles. (A possibility for the explanation of gravity.)" ROBERT FRICKE. *Giessen. Z. physik. Chem.* 97, 464-6(1921); cf. *C. A.* 14, 3348.—Addenda and a correction.

H. JERMAIN CREIGHTON

**Colloidal calcium phosphate.** G. M. DE TONI. *Kolloid. Z.* 28, 145-8(1921).—The  $\text{Ca}_3(\text{PO}_4)_2$  was formed by adding slowly and with const. agitation, nearly boiling  $N \text{ Na}_3\text{PO}_4$  soln., largely diluted, to an equal vol. of hot  $N \text{ CaCl}_2$  which had also been largely dild. and mixed with the desired quantity of gelatin as protective colloid. Cold solns. react slowly and remain clear for a long time. Besides, adding the phosphate to the  $\text{CaCl}_2$  insures an excess of Ca ions and the formation of  $\text{Ca}_3(\text{PO}_4)_2$ . Gelatin gives a ppt. with  $\text{Na}_3\text{PO}_4$  and is therefore added to the  $\text{CaCl}_2$ . The  $\text{Na}_3\text{PO}_4$  soln. was made by adding the calcd. amt. of NaOH to a soln. of  $\text{Na}_2\text{HPO}_4$  dilg. to  $N$ , and then carefully protecting from the air. By varying the concns. it was found that to make colloidal solns. contg. 2.068, 3.102 and 4.137 g.  $\text{Ca}_3(\text{PO}_4)_2$  in 1000 cc., none of which would show a ppt., there were required, resp., 9.5, 17.0, and 27.5 g. gelatin. Gum arabic, blood serum, and starch also serve as protective colloids, but sugar and caramel do not give



colloidal  $\text{Ca}_3(\text{PO}_4)_2$ . The formation of colloidal  $\text{Ca}_3(\text{PO}_4)_2$  is of importance in *ossification as well as in therapeutics*. [Also in *milk*. ABSTR.]

JEROME ALEXANDER

Researches on gold sols. ERICH KNAPFL-LENZ. *Kolloid. Z.* 28, 149-63(1921).—Gold sols were prepd. by Zsigmondy's method, using  $\text{AcH}$ , trichloroacetaldehyde,  $\text{BzH}$ , cinnamic aldehyde, terephthalic aldehyde and  $\text{AsH}_3$  as reducing agents. The various sols acted uniformly as to color changes with  $\text{KCl}$ ,  $\text{BaCl}_2$  and albumin, indicating that there was no chem. combination between the Au and the various acids produced in the reductions. This conclusion is further confirmed by the fact that the distribution of  $\text{As}_2\text{O}_3$  between pptd. Au and filtrate may be readily varied, indicating that the As is a mere impurity.

JEROME ALEXANDER

The effect of foreign substances on the production of colloidal gold solutions by the formol method of Zsigmondy. KARL HIEGE. Georg-August-Universität, Göttingen. *Diss.* 1914, 46 pp.—Colloidal substances can have an injurious influence (a) in consequence of their tendency to unite with the Au particles, (b) by reason of their elec. charge. To colloids of the first group belongs stannic acid ( $\text{SnO}_2$ ) which in a concn. of  $0.25 \times 10^{-2}$  millimol.-l. reduces the number of Au nuclei by approx. one-half, to those of the second group colloidal Fe oxide ( $\text{Fe}_2\text{O}_3$ ) which in spite of an initially favorable influence causes blue coagulated hydrosols on addition of  $0.48 \times 10^{-2}$  millimol.-l.  $\text{Fe}_2\text{O}_3$ . With some colloids of the first class, such as gelatin, Na protalbinat, the soaps, stannic acid and old silicic acid, a max. turbidity is observed and at the same time (with the exception of the stannic and silicic acids) in higher concns. a marked retardation in the rapidity of crystn. This was also observable with traces of oils and fats as well as with colloidal S ( $\text{H}_2\text{S}$ ). Starch, gum arabic and fresh silicic acid had a favorable influence. KBr and KI retard the rapidity of crystn.  $\text{NH}_3$ ,  $\text{NH}_4\text{Cl}$ ,  $\text{K}_4\text{Fe}(\text{CN})_6$  and  $\text{K}_4\text{Fe}(\text{CN})_6$  harmfully effect spontaneous nuclei formation, while small additions of  $\text{K}_2\text{MnO}_4$ , Congo red and benzopurpurin,  $\text{K}_2\text{C}_2\text{O}_4$ , K citrate, K benzoate, Na formate, Na acetate and morphine and brucine hydrochlorides favor it.  $\text{NaNO}_3$ ,  $\text{Na}_2\text{SO}_4$  and rosaniline hydrochloride were harmful in consequence of their electrolytic effect. So also were  $\text{KCl}$ ,  $\text{KBr}$ ,  $\text{KI}$ ,  $\text{Ca}(\text{NO}_3)_2$ ,  $\text{Sr}(\text{NO}_3)_2$ ,  $\text{Ba}(\text{NO}_3)_2$  and  $\text{HgCl}_2$  which, however, were initially favorable.  $\text{Fe}(\text{NO}_3)_3$ ,  $\text{Al}_2(\text{SO}_4)_3$ ,  $\text{CuSO}_4$ ,  $\text{NiSO}_4$ ,  $\text{CoSO}_4$  and  $\text{Cr}(\text{NO}_3)_3$  ppt. the Au by means of colloidal dissolved oxides positively charged. The addition of  $0.76 \times 10^{-2}$  millimol.-l.  $1/3\text{K}_4\text{Fe}(\text{CN})_6$  almost completely hindered the power of nuclei formation so that nuclei which were added grew to ultramicroscopically visible particles. This fact was used as the basis of a method for the detn. of the size of the particles in the nuclear sols. The linear dimension of the individual particles was found to be  $3.15 \mu$ .

ALBERT R. MERZ

Further investigations on the Bechhold capillary phenomenon. W. KRAUS. *Kolloid. Z.* 28, 161-6(1921); cf. Bechhold, *C. A.* 15, 458.—The concn. of salts at the surfaces of porous bodies which have been soaked in their sols. depends upon evapn. and does not occur in a damp room. If a hydrophile colloid (gelatin) be added to the salt soln., the concn. occurs only at higher temps.; it is also partially inhibited if the capillarity of the porous body is reduced by paraffin. Strips of impregnated filter paper placed between glass plates so that there is an exposed end also show the phenomenon, which is less marked the greater the adsorbability of the solute, but is independent of the degree of dispersion of the solute. When drops of soln. are dried on a flat surface possessing porosity (e. g. glass), the solute concentrates at the rim of the drop; but if the glass be paraffined, neither crystalloid nor colloid solutes show concn. Sols. possessing high viscosity also fail to exhibit concn. *Rhythmic rings* can be formed in inorganic gels (e. g. ferric oxide hydrosol) if saponin be added and a dye soln. layered over it.

JEROME ALEXANDER

Adsorption by carbon. H. HERBST. *Biochem. Z.* 115, 204-10(1921).—A study of the adsorption capacity for  $\text{CO}_2$  of c. p. wad, dried wood, paraffin, finely pulverized

sugar, silicic acid, Al cream and Zn cream gave uniformly negative results. When the wadding and sugar were carbonized, the adsorption which took place demonstrated that this high degree of adsorption capacity is a sp. property of the pure, free, chem. unsatd. C, and also that this capacity depends upon the chem. nature of the surface as well. With wood charcoal it was found that an increasing adsorption capacity accompanied a decreasing  $H_2O$  content of the carbonized wood. Impurities could be removed by extg. with benzene,  $Et_2O$ ,  $CS_2$ , pyridine, and  $(CH_3)_2CO$  under high pressure. The extractives could be removed and recovered by distn. Other methods of purification, such as treatment of the charcoal with H or Cl, fusion with  $K_2CO_3$ ,  $Na_2CO_3$  or  $MgCO_3$ , and  $ZnCl_2$  were used. Among the factors which det. the amt. of adsorption and the adsorption velocity are: the purity of the C and its "true" activity; the customary porosity of the C which primarily regulates the adsorption velocity; the ultra-porosity, which conditions the "apparent" activity and consequently the dependence of the adsorption capacity on the size of the adsorptive mols.; and graphitization.

F. S. HAMMETT

**Surface forces in heteropolar crystal lattices. Adsorption of lead isotopes b colloidal silver halides.** KASIMIR FAJANS AND K. V. BECKERATH. Munich. *Z. physik. Chem.* 97, 478-502(1921).—The paper deals with a kind of adsorption from solns., which depends on the addition of dehydrated ions of the soln. to the oppositely charged ions of the crystal lattice. To this variety of ionic adsorption the charging and discharging of colloids can be traced back in many cases. Colloidal chem. knowledge indicates that Paneth's rule (cf. *C. A.* 9, 553, 1875) for the adsorption of radioactive elements holds also for the adsorption effect by the addition of ions to the crystal lattice, i. e., those ions are equally well adsorbed by an ion-lattice whose union with the oppositely charged component of the lattice is difficultly sol. in the solvent employed. In agreement with this it is shown: (1) that Ag halide sols, which are positively charged by the adsorption of Ag ions, do not appreciably adsorb Th B (isotopic with Pb); (2) that Ag halide sols, in the presence of an excess of halogen ions, adsorb Th B and that the degree of adsorption increases with the concn. of the excess of halogen ions; (3) that the quantity of Pb adsorbed by negative AgBr sol is proportional to the Pb concn. up to  $0.25 \times 10^{-3}$  millimol. per liter  $Pb(NO_3)_2$ , and that at higher concns. the quantity adsorbed decreases.

H. JERMAIN CREIGHTON

**Researches on protective colloids. Ninth series. Isinglass (ichthyocolla) as protective colloid.** (1) General colloid-chemical investigations on the viscous solution of isinglass. A. GUTHRIE AND P. BECKMANN. *Kolloid-Z.* 28, 167-72(1921).—The viscosity of dil. isinglass solns. increases slightly for 5 days and then slowly decreases. Boiling for half an hour sharply reduces the viscosity, after which it slowly increases. With HCl and KCl maximum viscosity is shown at 0.25 N; with NaOH it steadily diminishes with increasing concns; but on heating both the acid and the alkali produce a steady decrease in viscosity.

JEROME ALEXANDER

**A simple Tyndall photometer for investigation of coagulation.** A. SEKERA. *Kolloid-Z.* 28, 172-4(1921).—The soln. is placed in a glass trough-shaped vessel having a transparent window through which the intensity of the Tyndall cone formed by a beam of light passing just behind the window, may be compared with the illuminated disk of a photometer placed alongside. The illumination of the disk is varied by moving a standard light along a scale.

JEROME ALEXANDER

**Improvement of the method of capillary tubes (for measuring surface tension).** C. A. PRÉDESCU. *Bull. sec. sci. acad. Roumaine* 6, 178-81(1919-20).—A circular mark is placed on the tube to be used for measuring the height of the liquid, and the edge of the meniscus adjusted to this mark each time. The tube is placed in a deep reservoir containing the liquid, so that this adjustment will always be possible. The capillary is supported vertically, the adjustment of the meniscus made by raising or lowering

the reservoir, and the rise in the capillary detd., *e.g.*, by means of a cathetometer. After check detns. are made, the app. is washed thoroughly before another liquid of a series is used. After all of the measurements are finished, the tube is cut at the mark, and the radius detd. by the method of Poiseuille. The consts. for all of the liquids will therefore have the proper relative values, and abs. values dependent upon the accuracies of the measurements other than the radius of the capillary. The detn. of the radius can be effected indirectly by using a liquid of known surface tension, as, *e.g.*, water.

W. F. FARAGHER

The effect of finely divided materials on the freezing points of water, benzene, and nitrobenzene. F. W. PARKER. *J. Am. Chem. Soc.* **43**, 1011-8(1921).—Finely divided insol. material (*e.g.* soil) depresses the f. p. of a liquid when the liquid forms a capillary film at the solid surfaces. This effect is additive to that produced by substance in soln.; therefore the *conc.* of soil solns. cannot be measured by f. p. methods unless at very high moisture content. This phenomenon is of biol. importance. J. A.

The action of the force of gravity and centrifugal force upon solutions. G. GOUV. *J. chim. phys.* **18**, 362-65(1920).—Largely mathematical. One of the applications of the formulas deduced is to the problem of osmotic elevation, the lower end of the tube being closed by a semi-permeable membrane. The hypothesis of homogeneity of the soln. leads to a classic relation which nearly all authors give as exact, but which can permit of such treatment only when the membrane is immersed to a certain depth in the soln. With the usual dimensions of the containing vessels the difference in concn. at different levels remains small. It is when centrifugal force, very great compared with *g*, is applied to solns. that marked differences in concn. are to be noted. Even then the mean displacement of the dissolved substance would be very slight, of the order of a few microns, when centrifugal force of 107 c.g.s. units is applied.

J. T. R. ANDREWS

The solubilities of calcite and aragonite. HANS L. J. BÄCKSTRÖM. *Medd. Vetenskapsakad. Nobelinst.* **4**, No. 11, 11 pp.(1921).—The solubilities of calcite and aragonite in the presence of CO<sub>2</sub> were measured in order to obtain a basis for an exact thermodynamical calcn. of the transition temp. Under these conditions the free energy of transformation (*F*) in cal. may be calcd. from the formula,  $F = 1.985 T \ln(K_a/K_c)$ , where *T* is the abs. temp., *K<sub>a</sub>* the soly. product const. for aragonite and *K<sub>c</sub>* the soly. product const. for calcite. The soly. expts. were made in 500-cc. flasks, which were held at const. temp. (+ 0.02°) in a large thermostat. The CO<sub>2</sub> was brought up to the correct temp. and satd. with water vapor before it entered the reaction bulb. The concns. of the solns. were detd. either by titrating with 0.025 *N* HCl or by measuring the elec. cond. The substances used for the soly. detns. were Iceland spar and synthetic calcite and aragonite, which were made by mixing very dil. solns. of K<sub>2</sub>CO<sub>3</sub> and CaCl<sub>2</sub> so slowly that only 0.6 g. of CaCO<sub>3</sub> pptd. in an hr. Pure aragonite was formed at 85-90° and calcite at room temp. The first results obtained were irregular owing to small size of the crystals and the influence of surface energy, so the final expts. were made with aragonite, prepd. by heating in a sealed tube at 140° a mol. soln. of CaCl<sub>2</sub> (satd. with CO<sub>2</sub>) and urea, and with calcite obtained by grinding Iceland spar and removing all particles smaller than 10 μ by decanting with cond. H<sub>2</sub>O. The aragonite contained about 0.5% calcite and 0.06% urea. In the expts. with aragonite the equil., which was detd. from both sides, was reached usually within 20 hrs. At 25° and 30° the concns. in g.-equiv. per l. were 0.02130 and 0.01751. At 9° the results were singular, but the most probable value for the specific cond. in mhos at equil. was  $1534 \times 10^{-4}$ . In the calcite expts. equil. was never reached because of the extremely small velocity of reaction in the neighborhood of this value. Subsequent expts. with the same substance used in previous expts. showed a steady decrease in the velocity of reaction. The most likely values for the concns. of the solns. in equil. at 9°, 25° and 35° were

0.0200, 0.01884 and 0.01529 g.-equiv. per l. The values of  $F$  obtained from the equation given were 160, 191.3 and 220.6 cal. at 9°, 25° and 35°. The heat of transformation at 30° as calcd. from the Helmholtz formula was -670 cal., and the transition temp. was found to be -43°. The variation of transition temp. with pressure as calcd. from the formula of Clapeyron shows that aragonite cannot be the stable phase under natural conditions except in the coldest regions on earth, because in the deeper strata of the earth's crust the increase in pressure is not sufficient to outweigh the increase in temp.

G. W. STRATTON

**New high vacuum methods in chemistry.** M. VOLMER. Hamburg Univ. Z. *angew. Chem.* 34, Aufsatzteil 149-51(1921).—V. in collaboration with the firm of Hanff and Buest has made a poly-stage *Hg vapor jet pump* of so simple a form that it is easily made of either glass or fused quartz. A picture, but not the details of construction, is given. In chemistry the high vacuums obtained with these rapidly operating pumps may be used with advantage in making vacuum distns., detg. mol. wts., and in studying thermal and photochem. decompns. A diagram of an arrangement for carrying out fractional distns. is shown. Above the liquid to be distd. and below a condenser are suspended a number of dishes one above the other. The lightest fraction collects in the highest dish, whose outer wall serves as a condenser for the one hanging beneath it, etc., and thus the sepn. here is not the result of the periodical interruption of the distn., but a consequence of the fall in temp. which corresponds to the condensers. The Bunsen diffusion method of detg. mol. wts. is in its early form only applicable to gases. But if it is applied at pressures from 0.01 to 0.10 mm. a great number of substances can be investigated whose vapor pressures at room temp. are of this order of magnitude or higher. A diagram of a suitable app. for this kind of work is shown. By operating at low pressures and using a McLeod gage, ordinary methods of studying the rate of evolution of gases from solids may be made 10,000 fold more sensitive. The effect of very small amts. of different catalyzers on the rate of decompn. of *nitrocellulose* at 100° has been studied. In one-half hr. the following pressures in microns of Hg were developed with the different catalyzers:  $H_2SO_4$  300, pyridine 52,  $Na_2CO_3$  46,  $HNO_3$  8, and  $FeCl_3$ ,  $HCl$ ,  $H_2O$ ,  $CH_3COOH$ ,  $Zn(NO_3)_2$ ,  $HgCl_2$ ,  $Fe_2O_3$ ,  $ZnO$ ,  $CaCO_3$  and camphor 13-16. *Photochemical* decompn. of nitrocellulose is unaffected by any of the catalyzers noted. Nitrocelluloses of different origins and widely different thermal stabilities show without exception nearly the same light sensitivity.

DUNCAN MACRAE

**The oxidation of carbon monoxide by passage with oxygen or air through the silent discharge and over ozone-decomposing catalysts.** A. B. RAY AND F. O. ANDEREGG. *J. Am. Chem. Soc.* 43, 967-78(1921).—The yield of ozone in several types of discharge tube was found to be dependent on a variety of factors. Usually an optimum flow rate was observed. Moist gas, a silvered electrode or a small arc in series diminished the yield of ozone. CO in contact with O would be completely oxidized if allowed to remain long enough in the discharge. Dil. ozone in the absence of a catalyst has little if any effect on CO. Ag was found to be the best to catalyze the reaction between ozone and CO. Pb and  $PbO_2$  are less effective while  $MnO_2$ , unless specially prepd., is worthless for this reaction, although it completely decomposes ozone. The best results were obtained by passing the air-CO mixt. through a very large discharge tube (described by Harding and McEachron, *C. A.* 14, 2135) and then over silvered asbestos. Because more CO was oxidized than would be accounted for by the ozone present either an active modification of CO or of O other than ozone is suspected. The presence of H has no effect. With the present available app. this method is impracticable for removing CO from air.

F. O. ANDEREGG

**Theory of chemical affinity from the standpoint of polar cleavage and the law of mass action.** D. RUCHINSKY. Univ. Leipzig. *Z. physik. Chem.* 97, 257-303(1921).—The first portion of the paper is devoted to a discussion of the hermaphroditic nature

of the chem. elements, and the problem of the sum of the affinity forces of a chem. element. It is pointed out that if the normal potential of an element is regarded as the measure of its chem. affinity, the latter must be dependent on the position of the element in the electromotive series. Measurements have been made at room temp. of the electrodes  $\text{Te}|\text{Te}_2^{--}$  and  $\text{Te}|\text{Te}^{++++}$ . It has been found that the normal potential of Te as metal is  $E_{hk} \text{ Te} \leftarrow \text{soln.} = +0.558 \text{ v.}$ , and that of Te as metalloid is  ${}_oE_{hg} \text{ Te} \rightarrow \text{soln.} = -0.827 \text{ v.}$ , while the polarity potential of Te is  ${}_oE^\circ_k = 1.385 \text{ v.}$  From the results of the e. m. f. measurements it is shown that (1) the polar soly. product of the 2nd order in the case of Te is  $\lambda = (\text{Te}^{++++}) (\text{Te}_2^{--})^2 = 6.2 \times 10^{-27}$ , (2)  $K_{30} = (\text{Te}^{++++}) (\text{OH})^6 / (\text{TeO}_3^{--}) = 2 \times 10^{-41}$ , and (3) the polar soly. product of the 3rd order is  $\lambda_3 = (\text{TeO}_3^{--}) (\text{Te}_2^{--})^2 (\text{H}^+)^6 = \lambda \cdot \lambda_{\text{H}_2\text{O}} / K_w = 3.4 \times 10^{-108}$ . From the results obtained in the investigation it is concluded that the total affinity of a chem. element, i. e., the sum of its positive and negative affinities, is in no way related to the position of the element in the electromotive series; but that its polarity potential constitutes a direct measure of the total affinity of a chem. element, the latter being a function of the polar soly. product. The following rule is given for the simultaneous displacement of the normal potential: if a  ${}_oE_{hk}$  value of a chem. element is known then its  ${}_oE_{hg}$  value lies in the direction of less noble metals, while if the  ${}_oE_{hg}$  value is known the  ${}_oE_{hk}$  value lies in the direction of more noble metals. The hypothesis is put forward that the chem. elements which occupy the same vertical column of the periodic table have the same value for the polar soly. product of the 1st order. According to this the value of the polarity potential of F, Cl, Br, and I is the same. If the electronic dissociation of an element ( $M_2$ ) be represented as follows:  $M_2 \rightleftharpoons M^+ + M^-$ ,  $M^- \rightleftharpoons M + \ominus$ , where  $\ominus$  stands for the electron, then the element can be completely characterized (chem.) by the quantities  $\lambda = (M^+) (M^-)$ ,  $\delta = (M) (\ominus) / M^-$ , and  $\mu = (M) (\ominus)$ . By means of these quantities, the positive, negative and total affinities of an element can be described quantitatively.

H. JERMAIN CREIGHTON

**The equation of state for liquids.** K. K. JÄRVINEN. Helsingfors. *Z. physik. Chem.* 97, 445-58 (1921).—A mathematical paper, in which the following modified form of van der Waal's equation of state has been derived for monat. liquids:

$$p = k \cdot \frac{v^{1/2}}{v^{1/2} - b^{1/2}} \cdot \frac{RT}{v} - \frac{a}{v^{7/2}}$$

This equation has been applied to Hg and a number of the phys. consts. of this liquid, e. g., satn. pressure, compressibility, coeff. of expansion, etc., have been calcd.

H. JERMAIN CREIGHTON—

**van der Waals' cohesion forces.** P. DEBYE. *Nach. Kgl. Ges. Wiss. Göttingen, Math.-physik. Klasse* 1920, 55-73; *Physik. Z.* 21, 178-87.—The great range over which van der Waals' equation is valid is due to the fact that in it the mutual attraction of the mols. is taken into account. This attraction exists between all mols. So universal a phenomenon can depend only upon properties common to all mols. Assuming that the mol. is a system of elec. charges, an assumption which is in accord with modern at. theory, D. gives an elec. explanation for the attraction between mols. By means of known elec. laws and facts, D. shows first that if the mol. is a system of elec. charges, these charges cannot be rigidly fixed with respect to each other, but must be movable. This result is in accord with the fact that the index of refraction of all gases differs from unity. Hence each mol. is in an elec. field due to all the others and tends to move from points of lower to those of higher field strength. The result is that all the mols. tend to cluster together. van der Waals' equation may be written  $\{p + (A/V^2)\} (V-B) = GRT/M$  where A is a measure of the attraction of the mols., B is four times the actual vol. of the mols. in a vol. V of the substance considered, and G is the mass. The dependence of the total energy of a gas on its vol. is given by the

thermodynamic equation  $\partial U/\partial V = T\partial(p/T)/\partial T$ . Eliminating  $p$  between this and van der Waals' equation gives  $U = \Psi(T) - (A/V)$ . The portion of  $U$  which is due to the potential energy of the gas is obviously  $-A/V$ . Hence the problem of detg.  $A$  reduces to that of detg. the potential energy of the gas. Based on the hypothesis as to the elec. nature of the mol. mentioned above, D. detg. mathematically the potential energy of the gas and from it an expression for  $A$  in terms of the principal elec. moments of inertia, the mol. diam., and consts. which depend on the gas in question. Considering liquids, D. derives an expression for the surface tension in terms of its refractive index, principal elec. moments of inertia, mol. diam., and a const. Tables are given comparing the calcd. and exptl. values of the surface tension for different liquids. Combining Eötvös' law with van der Waals' equation an expression for the mol. surface energy is obtained in terms of the crit. temp. and Boltzmann's const. EARL E. LIBMAN

**Remarks on Nernst's hypothesis.** G. BRUHAT. *J. phys. radium* 2, 1-14(1921).—The hypothesis is treated in three parts. (1) The difference in entropy of a substance at room temp. and at a low temp. tends towards a finite value as the low temp. approaches zero. This demands that the sp. heat is zero at 0° abs. (2) The entropy at abs. zero is independent of the pressure. This necessitates the vanishing of the coeff. of expansion at 0° abs. (3) The entropy is independent of the physical state—solid or liquid. B. considers the evidence for the first two propositions, which he discusses only briefly, to be as good as the exptl. accuracy permits. The third part is considered in some detail, especially in regard to the vapor tension. It is shown that in most cases other formulas which are not in line with N.'s third hypothesis agree better with observed results than those based on it. E. D. WILLIAMSON

**The present state of pyrometry.** H. WEISS. *J. phys. radium* 2, 33-52(1921).—A general review. W. P. WHITE

**Specific heat of vapor.** A. LEDUC. *J. phys. radium* 2, 24-30(1921).—A short mathematical note on the formulas L. has deduced for the sp. heats of vapors in the neighborhood of the satn. point. Tables are given for water in the region 80-180° with a pressure range of 6 atms. E. D. WILLIAMSON

**The heat of combustion of benzoic acid, naphthalene and cane sugar.** (A critical inspection.) F. HENNING. *Phys. Techn. Reichsanstalt, Berlin. Z. physik. Chem.* 971, 467-77(1921).—From a study of the results previously published on measurements of the heat of combustion of  $C_6H_5CO_2H$ ,  $C_{10}H_8$  and  $C_{12}H_{22}O_{11}$ , H. concludes that the values are such that it is not possible to come to a decision as to which of these is best suited for a normal detn. The abs. values of the heat of combustion of different observers have a max. deviation of 2.5% from the mean value; and the ratios of the heat of combustion of each of these substances to that of each of the others show for the data of different observers differences of 2-3%. Since the means of the abs. values do not give the same ratios as the mean of the individual ratios, the most probable abs. values have been calcd.:  $C_6H_5CO_2H$ , 6320 cal./g. (vac.) = 26444 (joule/g. vac.);  $C_{10}H_8$ , 9617 cal./g. (vac.) = 40239 joule/g. (vac.);  $C_{12}H_{22}O_{11}$ , 3949 cal./g. (vac.) = 16523 joule/g. (vac.); and, therefore,  $C_{10}H_8/C_6H_5CO_2H = 1.5216$ , and  $C_{12}H_{22}O_{11}/C_6H_5CO_2H = 0.6248$ . The accuracy of each of these values is estd. to be 1.5%. It is suggested that combustion calorimeters should be calibrated by carrying out measurements with  $C_{10}H_8$ ,  $C_6H_5CO_2H$  and with  $C_{12}H_{22}O_{11}$ , and the mean of the 3 individual detns. taken as the capacity of the calorimeter. In conclusion there are given correction factors, based upon the foregoing data, for converting previously detd. values of the heat of combustion into the most probable abs. value.

H. JERMAIN CREIGHTON

**The relation between boiling point in the vacuum of the cathode light and critical temperature.** P. WALDEN. *Z. anorg. allgem. Chem.* 112, 225-32(1920).—Making use of the data given by Krafft (*Ber.* 29, 1310-28(1896); 32, 1623-35(1899) for a number

of paraffins, fatty acids and their esters, and benzene homologs of high mol. wt., it is shown that the ratio of the abs. b. p.,  $T_b$  at 15 mm., to that,  $T_0$ , in the vacuum of the cathode rays, has a mean value of 1.2. The ratio between the b. ps. at 15 mm. and 760 mm. is given by  $T_{15}/T_{760}=0.765$ . It follows that  $T_{760}/T_0=1.59$ , which is identical with the mean exptl. value for the higher paraffins. This value is practically identical with that found by van Laar for the ratio of the critical temp. to the boiling temp. at atm. pressure,  $T_k/T_{760}=1.60$ . Hence the critical temp. is 2.54 times the boiling temp. in the highest vacuum. In the case of the metals, K, Na, Ag and Cu, the relation between  $T_{760}$  and  $T_0$  is expressed by  $T_{760}=4.55T_0/\log T_0$ . The above relation between critical temp. and b. ps. is applied to calc. the critical temp. of metals. For those metals of which the b. ps. in abs. vacuum are not known, this is calcd. from the relation that  $T_0/T_{vap.}=1.8$ , where  $T_{vap.}$  is the temp. at which vaporization begins in the vacuum of the cathode rays.

J. C. S.

**Rule of three temperatures.** MAURICE PRUD'HOMME. *J. chim. phys.* 18, 359-61 (1920); *Ann. chim.* 15, 212-20 (1921).—Having shown that the crit. temp.,  $T_c$ , the b. p.,  $T_b$ , and m. p.,  $T_f$ , all taken on the abs. scale, are related by the equation:  $T_f(T_c - T_f)/T_i(T_c - T_i) = r$ , where  $r$  is a const. for like or analogous groups of elements or series of compds., it remained to study for a number of substances the value of the

relationship:  $\frac{T_c}{T_i + T_f} = r'$ . It happens that for the substances observed,  $r$  and  $r'$  are very nearly equal, and neither differs from unity by more than a few hundredths. The values of  $T_c$  and  $T_i$  are for pressure of 760 mm. At lower pressures  $r'$  for most of the substances approaches close to unity. "It is conceivable that for every substance there exists a vapor tension such that the sum of the abs. b. p. and abs. m. p. temps. shall be equal to the corresponding abs. crit. temp."

J. T. R. ANDREWS

**The thermal expansion of liquids.** W. HERZ. Univ. Breslau. *Z. physik. Chem.* 97, 376-80 (1921).—It is shown that the Thorpe-Rücker equation,  $V_0/V_t = (a\theta - T)$  ( $a\theta - 273$ ) (where  $V_0$  and  $V_t$  represent the sp. vol. of the liquid at  $0^\circ$  and at  $t^\circ$ ,  $\theta$  is the crit. temp. and  $T$  the temp.  $t$  on the abs. scale), holds only over a limited range, because the "const."  $a$  is in reality not const. but decreases as the temp. increases. For the majority of analogous substances,  $a$  increases with mol. or at. wt. The magnitude of  $a$  lies between 1.5 and 2.1 for all temps. and for all substances, with the exception of  $H_2O$ . The quantity  $a$  occurs also in the expression,  $\alpha = 1(a\theta - T)$ , for the coeff. of expansion of liquids (cf. *C. A.* 7, 1128). From this it is evident that the coeff. of expansion  $\alpha$  is smaller the higher the crit. temp. of the liquid.

H. J. C.

**Thermal expansion and compressibility of liquids at low temperatures.** III. W. SEITZ. *Ann. Physik* 64, 661-70 (1921); cf. *C. A.* 10, 1953.—Theoretical considerations of the results published in I and II on iso- $C_6H_{12}$ ,  $Et_2O$ ,  $MeOH$ ,  $EtOH$ , and  $CS_2$  are given, including tables of the values of  $dU/dv$ , the change of energy with vol., at pressures from 0 to 1000 atm. and temp. from  $0$  to  $-100^\circ$ , and graphs of the relation between  $dU/dv$  and  $v$ . The ratios at corresponding points between the values of  $P$ ,  $v$ ,  $T$  agree with the ratios of the crit. consts. of the substances fairly well, in accord with the van der Waals' theory.

E. N. BUNTING

**Equilibrium in condensed systems.** ALFRED SCHULZE. Techn. Hochschule, Charlottenburg. *Z. physik. Chem.* 97, 388-416 (1921); cf. *C. A.* 7, 2887.—Measurements have been made of the vapor pressure of mixts. of  $CH_3CO_2C_2H_5$  and  $C_6H_6$  at  $20$  and  $30^\circ$ , of  $C_6H_6$  and  $CHCl_3$  at  $20$ ,  $35$  and  $90^\circ$ , and of  $CH_3CO_2C_2H_5$  and  $(CH_3)_2CO$  at  $0$  and  $20^\circ$ . In accordance with the rule that the partial pressure of each component of a liquid mixt. is equal to the satn. pressure of the pure component multiplied by the mol. fraction of this component in the mixt., the vapor pressure measurements of  $CH_3CO_2C_2H_5$ - $C_6H_6$  and  $C_6H_6$ - $CHCl_3$  show that the components in both mixts. enter

into chem. combination in the proportion 1:1. Further, the vapor-pressure measurements indicate that at 20°  $(\text{CH}_3)_2\text{CO}$  consists of double mols., while at 0° it produces higher mol. complexes. The mass action consts. for the 3 mixts. have been calcd. for several temps. from the vapor pressures, and from these the mol. constitution of the liquid mixts. has been deduced. In the same way the mol. heat, the mol. refraction, and other phys. properties of the mixts. have been evaluated. The values obtained are in good agreement with those obtained by expt.

H. JERMAIN CREIGHTON

**Vapor pressure and molecular volume of benzene-toluene mixtures.** ALFRED SCHULZE. Techn. Hochschule, Charlottenburg. *Z. physik. Chem.* 97, 417-25 (1921); cf. *C. A.* 14, 1916 and preceding abstract.—The vapor-pressure curves of  $\text{C}_6\text{H}_6\text{-C}_7\text{H}_8$  mixts., which at ordinary temps. are concave towards the concn. axis and finally become rectilinear at 60°, remain rectilinear at higher temps. (at 79.7 and 120.3°). The vapor-pressure isotherms show that at room temp.  $\text{C}_7\text{H}_8$  is fairly highly associated. The vol. dilatations which occur on mixing  $\text{C}_6\text{H}_6$  and  $\text{C}_7\text{H}_8$  also indicate this. On the assumption that one of the components consists of double mols., a theory of vol. dilatation is developed, and with the help of the mol. constitution of the mixt. (determ. from the vapor-pressure measurements) the vol. dilatation curve is constructed. This is in excellent agreement with exptl. data. The results of this and the preceding investigation constitute an advance in the theory of concd. solns.

H. J. C.

**The theory of volume dilatation for concentrated solutions.** ALFRED SCHULZE. Techn. Hochschule, Charlottenburg. *Physik. Z.* 22, 177-9 (1921).—It is shown that in a g.-mol. of liquid mixt., consisting of a non-associated liquid, *A*, and an associated liquid, *B*, in which there are present  $\xi$  g.-mol. of *A*,  $x_1$  g.-monomol. of *B*, and  $x_2$  g.-bimol. of *B*, the number of analytical g.-mols. present in the mixt. is  $\xi + x_1 + 2x_2 = 1 + x_2$ . For such a mixt. the dilatation per analytical g.-mol. is  $\Delta V = [(2V_1 - V_2)/(1 + x_2)] \{ x_2'(1 + x_2') \} (x_1 + 2x_2) - x_2$ , where  $V_1$  and  $V_2$  are the mol. vols. of the components and  $x_1'$  and  $x_2'$  the fractions of monomols. and bimols. in a g.-mol. of pure *B*. It is also shown that  $V_2 = [V_0(1 + x_2')/x_2'] - [V_1x_1'/x_2']$ , where  $V_0$  is the vol. of an analytical g.-mol. of liquid *B*. By means of these 2 equations, the mol. vols.  $x_1$  and  $x_2$  can be calcd. if the dilatation  $\Delta V$  is known. Once  $V_1$  and  $V_2$  have been found the vol. dilatation can be calcd. over the whole range of concn. These equations have been applied to mixts. of  $\text{Et}_2\text{O}$  and  $(\text{CH}_3)_2\text{CO}$ , and the exptl. results have been found to be in good agreement with the calcd. values.

H. JERMAIN CREIGHTON

**Thermodynamics of mixtures.** VI. MARIO BASTO WAGNER. Lisbon. *Z. physik. Chem.* 97, 330-6 (1921); cf. *C. A.* 15, 1446.—The paper presents a mathematical development of 2 theories of mixts. of any concn.: the one based on the 2 first laws of thermodynamics; the other based on these laws, the Nernst theorem for pure substances, and on the Planck postulate for mixts. While both theories give results which agree generally, it is pointed out that by means of an exhaustive comparison of these results with experience, it may be possible to arrive at a decision regarding the validity of Planck's postulate. VII. *Ibid.* 337-42.—A mathematical paper dealing with the absolute value of the entropy of mixts. It is shown that the entropy of a mixt., which is

given by the expression,  $S = \int_0^T \frac{C_p}{T} dT - R(n_1 \ln c_1 + \dots + n_\alpha \ln c_\alpha)$  where  $C_p$  is the heat capacity of the mixt. and  $n_1, \dots, n_\alpha$ , the number of mols. of each mol. species in the mixt., is zero at abs. 0. VIII. *Ibid.* 343-67.—A mathematical paper which deals with the general reversibility conditions of mixts., the Duhem-van der Waals reversibility conditions of a two-phase, pure, phys. system consisting of 2 components, and dil. phys. systems.

H. JERMAIN CREIGHTON

**The separation of miscible liquids by distillation.** A. F. DUFFON. Royal School of Mines. *Phil. Mag.* 41, 633-46 (1921).—The theory and the practice of the sepn. of two miscible liquids by distn. in a continuous system are considered. The equations



governing the sepn. are developed, and the lab. stillhead of S. F. Dufton (*C. A.* 13, 917) which gives perfect sepn. of binary mixts. was applied to the case of mixts. of benzene and toluene. Particular attention is paid to the thermal efficiency, which is defined as the ratio of quantity of heat theoretically required to produce sepn. to that actually employed. A table is given showing the necessary flow of heat for the sepn. of 1 g. of benzene from mixts. varying from 100% benzene to 100% toluene. To remove a trace of toluene from pure benzene 1.64 g. must be evapd. for each g. collected. The heat in cal. lost varies from 9 at 80–82° to 136 at 102–104°. For perfect thermal efficiency the liquid and vapor need be in equil. only at the top and bottom of the column. In the lab. test, with a Dufton column 105 cm. in length, the max. thermal efficiency was 44% for mixts. contg. 63–56% of benzene. With a shorter column (25 cm.) and a slower rate of heating, efficiency was obtained up to 78% for a mixt. contg. 78% of benzene. 21,000 cal. are theoretically capable of sepg. 100 g. of benzene from 100 g. of toluene in continuous distn. In discontinuous distn. the same amt. of heat will sep. only 78 g. of benzene, leaving 22 with 100 g. of toluene. In order to sep. 99 g., leaving 1 g. with the toluene, twice the amt. of heat is necessary. The principal advantage of continuous distn. is the ability to maintain the mixt. in the region of max. thermal efficiency.

S. C. LIND

**Equilibrium in the system ammonia : ammonium nitrate : ammonium thiocyanate.** H. W. FOOTE AND S. R. BRINKLEY. *J. Am. Chem. Soc.* 43, 1018–31(1921).—Vapor pressures at 0°, 10° and 20° were detd. in the binary systems of  $\text{NH}_3$  with each of the salts, and for three mixts. of the ternary system. No double salts or solid addition products with  $\text{NH}_3$  form at 0° or above; but the satd. solns. are in equil. with the simple salts. The soly. curves of  $\text{NH}_4\text{NO}_3$  and  $\text{NH}_4\text{CNS}$  in the ternary system were detd. at 0°, 10° and 20°, together with the univariant point in which these curves intersect. Anomalous vapor pressures are shown, but solns. of about the ratio  $1\text{NH}_4\text{NO}_3 : 3\text{NH}_4\text{CNS}$  show minimal vapor pressures and are, therefore, most efficient in absorbing  $\text{NH}_3$  from gas mixtures.

JEROME ALEXANDER

**Equilibrium in the system ammonia : ammonium thiocyanate.** H. W. FOOTE. *J. Am. Chem. Soc.* 43, 1031–8(1921).—Vapor pressures and soly. of  $\text{NH}_4\text{CNS}$  have been detd. for this ternary system at 0°, 10°, and 20°. The curves of equal-vapor pressure in the ternary system are nearly straight lines connecting points of equal-vapor pressure in the two binary systems.

JEROME ALEXANDER

**The system copper : cupric oxide : oxygen.** H. S. ROBERTS AND F. HASTINGS SMITH. *J. Am. Chem. Soc.* 43, 1061–70(1921).—There is no evidence of solid soln. between the solid components. From the  $T-X$  (m. p.) diagram is shown the general course of the  $P-T$  curves in the system. Data are given for the 3 dissociation-pressure curves in the ternary system. The m. p. of the  $\text{Cu}_2\text{O} : \text{CuO}$  eutectic is 1080.2° at 402.3 mm. Hg; the m. p. of  $\text{Cu}_2\text{O}$  is 1235° at 0.6 mm. Hg. The heat of fusion of  $\text{CuO}$  and the energy changes of the reaction  $(\text{CuO}) (S) \rightleftharpoons 1\frac{1}{2} (\text{Cu}_2\text{O}) (S) + \frac{1}{2} (\text{O}_2) (g)$  have been calcd. Equil. pressures for the dissociation of  $\text{Cu}_2\text{O}$  from 1119° to 1184° are given and agree with the other detns.

JEROME ALEXANDER

**Ammonates as binary systems.** I. FRITZ FRIEDRICH. *Cornell Univ. Z. anorg. allgem. Chem.* 116, 141–60(1921).—The various types of soly. curves are classified as follows: (1) The components form no compds. (2) One or more compds. of the 2 components are formed, giving a compd. with (a) a stable melting point, or (b) a metastable melting point. (3) Mixed crystals appear, in which (a) the series is continuous, or (b) the series is interrupted. (4) Sepn. of the liquid phases may occur. The isotherms corresponding to these classes are discussed. A study of the isotherms leads to a *tensimetric method for detg. soly.*, by the location of 5 points on the pressure-concn. curve at const. temp. The tension of the satd. soln. is detd. at 2 points, which should be chosen near the turning point of the curve, so that the amt. of sepd. crystals

is not great, since adsorption phenomena may delay the establishment of equil. if too little liquid is present. Since the curve for dil. solns. is not a straight line, it must be detd. by 3 points. One point should be in the metastable region of the supersatd. soln. Graphic interpolation then gives the soly. of the system at the temp. of the isotherm. The essential part of the app. described is a pear-shaped reaction cell, of about 10 cc. capacity, graduated in cc., and provided with a capillary tube, which also serves as a somewhat flexible connection, for the introduction of the gas, and with a side tube for the introduction of the other components. The reaction cell is shaken by a connecting rod attached eccentrically to a motor-driven pulley, the long spiral capillary permitting sufficient movement without danger of breaking. The const.-temp. bath is a Weinhold flask, containing the cell thermometer, and a Witt centrifugal stirrer making 2000 r. p. m., which gives excellent service, especially with mixts. of solid  $\text{CO}_2$  and ether-alc. The capillary connects the reaction cell with a Hg manometer 4 m. long, a gas buret, and an  $\text{NH}_3$  cylinder. The  $\text{NH}_3$  was dried over Na. A drop of Hg in the reaction cell, when the nature of the contents permitted it, aided greatly in the agitation. Exptl. data are evidently reserved for a later paper. M. R. SCHMIDT

**Relation between chemical resistance and constitution of binary systems (alloys).**

K. WAGENMANN. *Metall u. Erz* 17, 377-81, 402-8(1920).—From consideration of the available exptl. data on the resistance of binary alloys to solvents, with or without the presence of atm. O, it is concluded that if chem. compds. are possible between the constituents of the alloys a max. resistance to soln. is often found at concns. corresponding to these compds. In alloys, the constituents of which form mixed crystals, a max. occurs at the satn. concn. of these solid solns., or at least an increased resistance to attack occurs within the range of concn. corresponding to a solid soln. of the pure components. Resistance to chem. action is influenced by grain size of the alloy. A minimum in the resistance to attack is obtained with a heterogeneous structure, especially with a eutectic, in the lamellar structure of which electrolytic action probably takes place. In an appendix particulars are given of the methods and app. used in the expts.

J. S. C. I.

**Measurement of electrical conductivity in metals and alloys at high temperature.**

J. L. HAUGHTON. *Trans. Faraday Soc.*, June 1920 (advance proof); cf. *C. A.* 14, 3060. —An app. for the measurement of elec. cond. at high temps., up to  $1000^\circ$ , was designed primarily to det. the cond. of a series of alloys at varying temps., with a view to obtaining some information on their constitution. The principle on which the app. works is the measurement of the voltage drop along a fixed length of the specimen, through which a constant current is passing. This voltage drop is proportional to the resistance between the points of contact so long as the current is kept const. To ensure this, the same current is passed through a constantan strip, the resistance of which can be arranged to be of the same order as that of the specimen, and is accurately known, and the voltage drop along this resistance is measured with the same instrument and almost at the same time as that along the specimen. In this way, not only is the constancy of current checked (this being adjusted by means of a rheostat when necessary), but also the instrument which is reading the voltage drop is calibrated directly in some multiple of ohms.

J. S. C. I.

**The equilibrium conditions of the reaction between manganate, permanganate, (and potassium hydroxide), and manganese dioxide.** C. E. RUBY. *J. Am. Chem. Soc.* 43, 294-301(1921).—The reaction:  $3 \text{K}_2\text{MnO}_4 + 2 \text{H}_2\text{O} = \text{MnO}_2 + 2 \text{KMnO}_4 + 4 \text{KOH}$  has already been studied by electromotive-force methods by Sackur and Tagener (*C. A.* 7, 298), after these authors had decided that an analytical study could not be made, owing to the difficulties attending the estn. of substances present. The present author has made such a study, obtaining approx. values for the equil. const. Adopting the most reliable of the electromotive-force measurements of Sackur and Tagener,

the  $\text{MnO}_4^{2-}$ ,  $\text{MnO}_4^-$  electrode, the author was able to compute a value for the  $\text{MnO}_2$ ,  $\text{MnO}_4^-$  electrode, and for the  $\text{MnO}_2$ ,  $\text{MnO}_4^-$  electrode. A summary of the potentials, measured and calcd. is as follows:  $\text{MnO}_4^{2-}$ ,  $\text{MnO}_4^-$ —0.61 v.;  $\text{MnO}_2$ ,  $\text{MnO}_4^-$  ( $\text{OH}^-$ )—0.66 v.;  $\text{MnO}_2$ ,  $\text{MnO}_4^-$  ( $\text{OH}^-$ )—0.65 v.;  $\text{MnO}_2$ ,  $\text{MnO}_4^-$  ( $\text{H}^+$ )—1.76 v. The potential  $\text{MnO}_2$ ,  $\text{MnO}_4^-$  ( $\text{H}^+$ ) is not computed. The free-energy decrease ( $-\Delta F$ ) attending the above change in state at 45° is 10,500 j. C. E. RUBY

**Potential of the thallium electrode and the free energy of formation of thallos iodide.** GRINNELL JONES and WALTER CECIL SCHUMB. Harvard Univ. *Proc. Am. Acad. Arts Sci.* 56, 199-236 (1921).—Measurements have been made at 25 and 0° of the cond. and ionization of  $\text{TlNO}_3$  solns., of the soly. of  $\text{TlCl}$  and of  $\text{TlI}$ , and of the normal potentials of the  $\text{Tl}$  and the  $\text{I}$  electrodes. From the cond. data the equiv. conductance of  $\text{Tl}^+$  was found to be 78.36 mhos at 25° and 41.8 mhos at 0°. The equiv. concns. of the ionized fractions of  $\text{TlCl}$  and  $\text{TlI}$ , calcd. from the cond. of satd. solns. of these salts, are, respectively, 0.014094 and 0.000235 at 25°, and 0.006095 and 0.0000587 at 0°. From the potential measurements it has been computed that the normal potential of the  $\text{Tl}$  electrode is +0.6188 v. at 25° and +0.5885 v. at 0°, and that of the  $\text{I}$  electrode —0.3406 v. at 25° and —0.3399 v. at 0°. From the foregoing results the following are computed for the reaction:  $\text{Tl (solid)} + 0.5\text{I}_2 \text{ (solid)} = \text{TlI (solid)}$ : free energy of formation ( $A$ ) = 125.79 kj. at 25° and 125.48 kj. at 0°; heat of formation ( $U$ ) = 122.11 kj. at 25°. Contrary to the assumptions of earlier investigators, it has been found that a metallic  $\text{Tl}$  electrode is more negative than a satd. two-phase amalgam electrode by 2.8 millivolts at 25° and 1.8 millivolts at 0°. H. JERMAIN CREIGHTON

**The current resulting from the compression of a soldered joint.** M. POLANYI. Berlin-Dahlem. *Z. physik. Chem.* 97, 459-63 (1921).—It is concluded that if one of the soldered joints of 2 different metal wires, or 2 other substances such as semiconductors or solid electrolytes, forming a circular conductor are compressed, an e. m. f. must be set up in the system. This conclusion is based upon the assumption that the elec. current is always accompanied by a movement of material particles. A current produced in this way is called a "barelec." current. The barelec. tension must be easy to measure in many cases; with moderate pressures it must reach several centivolts. From measurements of the barelec. effect the transport numbers in solid electrolytes can be detd. as well as the ratio of electronic conduction to material conduction in poor conductors. H. JERMAIN CREIGHTON

**Electrical phenomena accompanying the replacement of metals (from solution).** BARLOT. *Compt. rend.* 172, 857-9 (1921); cf. C. A. 15, 1604.—The formation of "metallic spectra" is attributed to the influence of the electric field set up about an electric couple. The ions of the electrolyte are oriented in the direction of the lines of force and crystallize in the form of dendrites which follow these lines. Photographs of the effects are shown. C. R. PARK

**The back electromotive force of the aluminium rectifier.** A. GÜNTHER-SCHULZE. *Physik. Z.* 22, 146-8 (1921).—Criticism of the work of Greene (C. A. 8, 2520) and Fitch (C. A. 11, 917). C. R. PARK

**Study of the photo-active electrolytic cell, platinum-rhodamine-B-platinum.** CARLTON C. MURDOCK. *Phys. Rev.* 17, 626-47 (1921).—Goldmann and Thompson have each suggested equations to represent both the growth and decay of the current given by a photo-active electrolytic cell having electrodes of  $\text{Pt}$  and an alc. soln. of rhodamine-B as electrolyte. In each of these equations it is necessary to use different parameters after the first minute of the growth or decay; this may be due to the failure to correct for the inertia and damping of the galvanometer coil. A method for correcting the galvanometer deflections for these effects is discussed and correction equations are developed. Cells having as electrodes sputtered  $\text{Pt}$  films are found to give a current if not illuminated when the electrodes are not alike. This current tends to flow (a)

from the denser to the less dense electrode, (b) from the warmer to the cooler electrode. Data taken by subjecting the cell to exposures of ten min. or more (a) cannot be repeated, (b) are not, when corrected, in agreement with the above-mentioned equations. Data taken by exposures of 1 min. (a) may be repeated very exactly, (b) are not, when corrected, in agreement with either type of equation. The effect of length of exposure on the decay is investigated. It is found that the initial rate of decay is independent of the length of exposure. This is shown to be inconsistent with Goldmann's equation.

C. R. PARK

**The alleged non-serviceability of the Weston normal element. A reply to the communication of Messrs. Cohen and Moesveld.** W. JAEGER AND H. V. STEINWEHR. *Phys. Chem. Reichsanstalt, Berlin. Z. physik. Chem.* 97, 319–29 (1921).—It is claimed that the behavior of the Weston normal element with 12.5% amalgam, like that with 14.3% amalgam, is completely normal at ordinary temps., notwithstanding the assertions of Cohen and Moesveld (*C. A.* 14, 3184) to the contrary. Furthermore, it is pointed out that below the alleged transition point (12.1°) of 12.5% amalgam no deviations from the normal e. m. f. have been observed with any of the elements investigated at the Reichsanstalt, after being cooled from 60 to 0°. It is also pointed out that the deviation from the normal e. m. f. at 0°, observed by Smith (*C. A.* 4, 1258), refers to an amalgam which is suddenly cooled, and that such an element becomes normal again at room temp. It is claimed that the new measurements on which the assertions of C. and M. are based are not conclusive, because both of the elements considered show considerable deviations from the normal value above the "ramification point" without being previously cooled below this point. H. J. CREIGHTON

**Measuring the flow of gases.** R. G. KNOWLAND. *Chem. Met. Eng.* 24, 956 (1921); cf. Hayward, *C. A.* 15, 2022. ROBERT N. DONALDSON AND ROSS MCCOLLUM. *Ibid* —The calibration curves for capillary flowmeters detd. with measured quantities of air are not applicable to other gases, since the amt. of gas flowing through an orifice is inversely proportional to the sq. root of its mol. wt. and directly proportional to the sq. root of the ratio of the temp. of calibration to the temp. observed. If the density of the gas to be measured is known, the vol. passed may be detd. from the curve for air by multiplying by the following factor:  $f = 1/\sqrt{G} \times \sqrt{T_1/T_2}$ , where  $G$  = sp. gr. of the gas (air = 1),  $T_1$  = temp. of calibration (abs.),  $T_2$  = temp. observed (abs.).

DONALD W. MACARDLE

**Preparation of platinum sponge.** R. FEULGEN. *Univ. Giesesen. Ber.* 54B, 360–1 (1921).—The losses involved in the partial colloidal soln. of the Pt during the washing by decantation in the usual Löw-Willstätter method of prepn. can be avoided by proceeding as follows: 5 g. com.  $\text{PtCl}_4$  in 5 cc.  $\text{H}_2\text{O}$  and 7 cc. of 40%  $\text{HCHO}$  are gradually treated, with cooling, with 5 g.  $\text{NaOH}$  in 10 cc.  $\text{H}_2\text{O}$ , allowed to stand 0.5 hr., then 15 min. at 55°, poured into 250 cc.  $\text{H}_2\text{O}$  in a 500-cc. flask, shaken very vigorously for a few min. (whereupon the ppt. aggregates to flocks which settle immediately), decanted, treated with  $\text{H}_2\text{O}$ , made strongly acid with  $\text{AcOH}$  and again shaken vigorously; the ppt. once more aggregates to large flocks and can now be washed as much as desired without showing any tendency to pass over into a colloidal state. It is then filtered and dried *in vacuo* over  $\text{H}_2\text{SO}_4$ . So prepd., the catalyst is very active; 0.1 g. will completely hydrogenate 1 g. oleic acid in 10 cc.  $\text{AcOH}$  in 5 min.

CHAS. A. ROUILLER

**Crystallization, solidification, and devitrification.** A. PORTEVIN. *Rev. ing. index. tech.* 28, 165–77 (1921).—Review of general principles. A. P.-C.

**The velocity of unimolecular reactions (RIDEAL) 3. Light-sensitiveness of collodion (HOMOLKA) 5. Diameters of atoms (WESTPHAL) 3. The condition of electrons in electrolytic ions (GÜNTHER-SCHULZE) 3.**

ASKEW, H. R.: *Comparative Therm Tables*. London: Benn Brothers, Ltd. 72 pp. 5/6.

*Chemiker-Kalender 1921*. Newly edited by Walter Roth. 2 vols. 42nd Jahrgang. Berlin: Jul. Springer. M. 42. For review see *Z. deut. Öl-Fett-Ind.* 41, 104(1921).

COLES, A. C.: *Critical Microscopy*. London: J. and A. Churchill. 100 pp. 7s. 6d.

DIETRICH, WALTHER: *Einführung in die physikalische Chemie*. Berlin: Jul. Springer. M. 20.

MICHAELIS, LEONOR: *Praktikum der physikalischen Chemie, insbesondere der Kolloidchemie für Mediziner und Biologen*. Berlin: Jul. Springer.

MUNBY, A. E.: *Laboratories, their Planning and Fittings*. Historical introduction by A. E. Shipley. London: G. Bell and Sons, Ltd. 220 pp. 25s.

SPERONI, C.: *Guida alle esercitazioni di chimica per gli istituti tecnici*. Firenze: Le Monnier, 1919. For review see *Nuovo cimento* 19, 273(1920).

SVEDBURG, THE: *The Formation of Colloids*. London: J. and A. Churchill. 127 pp. 7s. 6d.

### 3—SUBATOMIC PHENOMENA AND RADIOCHEMISTRY

GERALD L. WENDT

Electricity and matter. ERNEST RUTHERFORD. *Engineering* 111, 296-7, 345-7, 379-81(1921).—A series of 3 lectures before the Royal Inst. reviewing the better known facts and theories concerning the at. nature of electricity and elec. structure of matter. F. O. A.

Electronic energy and relativity. FREDERICK SLATE. *Phil. Mag.* 41, 96-107(1921). G. L. W.

Electromagnetic theory of radiation. H. BATEMAN. *Phil. Mag.* 41, 107-13(1921). G. L. W.

The atomistics of electricity and phenomena with single radioactive test particles of magnitude  $10^{-5}$  cm. FELIX EHRENFHAF. *Physik. Z.* 21, 675-88(1921).—Further evidence of the existence of charges which are fractions of the ordinarily accepted electronic charge. Cf. C. A. 13, 1416 for detailed discussion of previous investigation. In the present case, drops of Se and Hg were charged with  $\alpha$ -particles from Po, and the motion of these drops was studied between charged plates. The observations lead to the conclusion already advanced by E. that the charge on any particle can vary by amts. which are much less than that of the electron. In the discussion of this paper Regener advanced the hypothesis that the drops might be surrounded by layers of gases in a condensed state. E. and Konstantinowsky argued against the possibility of this. E. Meyer, Born, Fuerth and Gerlach also took part in this discussion.

SAUL DUSHMAN

Radioactivity and electricity. F. EHRENFHAF AND D. K. KONSTANTINOWSKY. Vienna. *Ann. Physik* 63, 773-815(1920).—Minute spheres of Se obtained by evapn. in dry  $N_2$  were given an elec. charge and held suspended in an e. s. field of measurable intensity opposed to the earth's gravity field. The particles conserved their original charge steadily. Similar spheres of Se or Hg (diam.  $10^{-4}$ — $10^{-5}$  cm.) were then covered with Po or Ra active deposit and again observed in the elec. field. In addition to occasional sudden changes in velocity, these particles also showed a continuous change inexplicable on the usual electron theory. Even the non-radioactive particles occasionally had charges of smaller magnitude than that corresponding to one "electron." The charges observed seemed to be multiples neither of the "electronic" nor of any particular "sub-electronic" charge, but rather to vary continuously. NORRIS F. HALL

**The contributions from the polarization and magnetization electrons to the electric current.** A. D. FOKKER. *Proc. Acad. Sci. Amsterdam* 22, 850-72(1920).—A math. study of the relation between the possible-movements of electrons within the atoms and the resulting polarization, magnetization and transfer of current. The results are used to explain spontaneous elec. polarization of moving magnets. F. O. A.

**The periodic system, atomic structure and radioactivity.** FRANZ URBACH. Vienna. *Physik. Z.* 22, 114-9(1921).—A discussion of electron orientation very similar to the views of Lewis, Langmuir and Harkins. G. I. W.

**Radioactivity and the investigation of the elements.** OTTO HAHN. *Umschau* 25, 10-11, 18-21(1921).—A review. F. O. A.

**The elementary particle of positive electricity.** ARTHUR H. COMPTON. Washington Univ. *Nature* 106, 828(1921).—The view is advanced that the application of a distinctive name such as "proton" or "hylon" to the elementary particle of positive electricity (cf. Lodge, *C. A.* 15, 462) can only suggest a distinction between the nature of the positive and negative electrons which so far as is known does not exist. When an atom of H is split into its 2 components the negative electron is just as really a H ion as is the positive electron. The fact that both components possess equally fundamental divisions of matter should suggest that the same generic name "electron" be applied to both. W. H. ROSS

**The elementary particle of positive electricity.** ANDREW H. PATTERSON. Univ. North Carolina. *Nature* 107, 75(1921); cf. preceding abstr.—The term "hydron" for the name of the H nucleus is suggested in place of "hydron" as proposed by Soddy (*C. A.* 15, 462). W. H. ROSS

**Dimensions of atoms and molecules.** W. L. BRAGG AND H. BELL. *Nature* 107, 107(1921).—Estimates from crystal data and from viscosity measurements on the dimensions of atoms and mols., although not agreeing exactly numerically, lead to the same conclusions: (a) the elements at the end of any one period in the periodic table are very nearly identical as regards the diameters of their outer electron shells, and (b) in passing from one period to the next there is a definite increase in the dimensions of the outer electron shell. A further check is afforded by measurements on the infra-red spectra of HF, HCl, and HBr. also in *Science Progress* 16, 45-55.

MARIE FARNSWORTH

**Diameters of atoms.** WILHELM H. WESTPHAL. *Z. Physik* 4, 254-6(1921).—The difference between the at. "diameters" from viscosity measurements and from crystal structure data (Bragg, *C. A.* 14, 2584) can be used to calc. the law of force between the atoms, assuming Rankine's (*C. A.* 15, 462) interpretation of the difference. The result indicates a repulsive force proportional to the inverse cube of the distance.

F. C. HOYT

**Atomic structure and scattered radiation.** R. GLOCKER AND M. KAUPP. *Ann. Physik* 64, 541-65(1921).—In consequence of the regular arrangement of electrons in atoms it would be expected that even with random orientation of the atoms interference effects will occur when electromagnetic waves are incident so that the intensity of light scattered by the atoms will show maxima and minima in its space distribution. The rapid development of Röntgen spectroscopy has made it possible to compute the scattering effect for certain atoms (e. g., C, Al) on the basis of their atomic structure, and to compare this result with expt. This paper is largely a theoretical discussion in which Debye's theory of scattering is extended to electron systems of 2 and 3 rings. The C atom is now regarded as a 2-ring electron system but 2 cases of electron distribution are nearly equally probable; the periodic system points to an inner ring (K-ring) of 2 electrons, while the exact computation of the frequency of the K $\alpha$  line requires a K-ring of 3 electrons. Comparison of computed properties of C with existing observations indicates that the extended Debye theory of scattering, assuming a 2-ring

mass-scattering-coeff. makes a 2-electron inner ring and 4-electron outer ring C atom more probable than 3 electrons in each ring. The periodic system and results of Röntgen spectroscopy indicate that the 13 electrons in the Al atom may be so distributed that either 2 electrons fall in the inner, 8 in the middle and 3 in the outer ring or that the allotment is 3, 9 and 1. The theory of scattering deduces, (1) that the space-average of the scattering decreases as the electron number of the atom increases and (2) that the mass-scattering coeff. of the elements varies more rapidly with wave length the more electrons the atom has, so that  $s/\rho$  decreases with decreasing wave length. These results are roughly verified by the existing exptl. data but the number of electrons in each ring is not settled.

W. F. MCGUGAN

**The constitution of lithium.** F. W. ASTON AND G. P. THOMSON. Cavendish Lab. *Nature* 106, 827-8(1921); cf. *C. A.* 15, 462.—Results obtained in further expts. on the constitution of Li by the method of positive ray analysis appear to leave no doubt that Li is a complex element with isotopes of at. wts. 6 and 7.

W. H. ROSS

**The constitution of the alkali metals.** F. W. ASTON. Cavendish Lab. *Nature* 107, 72(1921); cf. preceding abstr.—By applying the mass spectrograph to the analysis of the positive rays of metallic elements generated by means of a heated anode it has been demonstrated that the mass spectrum of Na consists of a single line only. Assuming it to be exactly 23 then it is found that K gives a strong line at 39 and a very weak companion at 41. The relative intensities of the lines are not inconsistent with the accepted at. wt. and K therefore probably consists of 2 isotopes 39 and 41. Rb gives 2 lines 2 units apart of relative intensity about 3 to 1. Comparison with the K line 39 gives these the masses 85 and 87 to within a fraction of a unit. The fact that these values are in excellent agreement with the accepted at. wt. indicates that they are the wts. of the 2 isotopic constituents of Rb. The mass spectra of Cs have so far exhibited only one line which measured against the Rb lines indicates a mass 133. If another isotope of Cs exists it is present in proportions of less than 5%.

W. H. ROSS

**The normal orbit of the electron in the atom of mercury.** A. TERNIN. Optical Inst., Petrograd. *Nature* 107, 203(1921).—In an absorption expt. with non-luminous Hg vapor in the infra-red region it was found possible, using a photographic method, easily to reach  $\lambda = 11300 \text{ \AA}$ . All the photographs showed a complete absence of a marked absorption at  $\lambda = 10140$  although the pressure of Hg vapor reached 1 atm. The absence of a strong and characteristic absorption of  $\lambda = 10140$  by Hg vapor makes unnecessary the assumption of a second normal orbit in the Hg atom as suggested by Dearn.

W. H. ROSS

**A law of force giving stability to the Rutherford atom.** J. MARSHALL. *Proc. Royal Soc. Edinburgh* 40, 150-7(1919-1920).—A mathematical paper in which M. attempts to obtain a law of force which will "preserve the stability of a group of electrons rotating in the same plane about a positive nucleus in the simple cases in which the Bohr theory is applicable." He shows that for a law of force of the form  $f \propto \frac{1}{r^3} \left[ 1 - \frac{(b^2-1)}{r^2-1} \right]$

a value of  $n$  can be found which will preserve the stability of a group of electrons not exceeding 7 in number rotating in a circular orbit about a positive nucleus. For values of  $r$  that are great compared with the radius of the atom the term  $b^2-1/r^2-1$  becomes negligible and the inverse square law holds. The case of more than one ring of electrons is considered with the simplifying assumption that the effect of the inner ring can be replaced by an equiv. charge on the nucleus. The conclusion is that in this case stability may again result, but in no case may a ring hold more than seven electrons.

L. B. LOEB

**The condition of electrons in electrolytic ions.** A. GÜNTHER-SCHULZE. *Z. Physik* 3, 349-60(1920).—When a const. c. d. is maintained through an electrolytic cell the anode

of which is a valve metal, the e. m. f. across the cell increases with the time. This increase is accounted for by the formation of a gas envelope, and continues until at a definite point sparking takes place through the gas envelope and no further increase in the voltage is noted. These sparks have their origin in the electrolyte which is the cathode side of the envelope. The appearance of the cathode sparks is dependent upon the ionization of the cathode. The max. voltage is therefore dependent on the ease with which the anions give up their electrons. The max. voltage is approx. the same for all the metal-free anions, but is very much lower in the case of anions containing metals such as Pt, Mn, Cr, and Fe. The general explanation may be given for the particular case of the  $\text{CrO}_4^{--}$  and  $\text{SO}_4^{--}$  ions, the latter of which has the much higher max. voltage. The Cr atom in the  $\text{CrO}_4^{--}$  ion has a stronger attraction for the electrons of the O atoms than the S atom in the  $\text{SO}_4^{--}$ . The electrons in the case of Cr are held approx. half way between the field of the Cr and the O and may be more easily discharged than in the case of S. There is a definite relation between this attraction and the at. vol., that of the Cr being smaller than that of S. The max. voltage is therefore a measure of the attraction of the metal for the electrons. The so-called soln. potential is a measure of the same attraction. The metals arranged in the order of max. voltage are in approx. the same order as the e. m. f. series. C. R. PARK

**Similarity between carbon dioxide and nitrous oxide.** A. O. RANKINE. *Proc. Roy. Soc. (London)* 98A, 369-74(1921).—According to Langmuir's theory these 2 mols. "have each of them an external arrangement which is the same as that of 3 Ne atoms in line and contiguous." Applying the same considerations as in the preceding paper, R. calcs. the mean collision area for each of these mols. from the crystal structure data for the diam. of the Ne atom and finds the value  $0.895 \times 10^{-18} \text{ cm}^2$  as an av. of 3 different methods. From the viscosity data, the mean target areas of the mols. are:  $\text{CO}_2$ ,  $0.870 \times 10^{-18} \text{ cm}^2$ , and  $\text{N}_2\text{O}$ ,  $0.867 \times 10^{-18} \text{ cm}^2$ . The agreement is considered very satisfactory.

SAUL DUSHMAN

**Molecular structure and energy.** J. R. PARTINGTON. East London College. *Nature* 107, 172(1921).—Attention is called to the apparent discrepancy between the facts and the latest theory of at. and mol. structure inasmuch as the models of the  $\text{CO}_2$  and  $\text{N}_2\text{O}$  mols. proposed by Rankine (preceding abstract), although they agree well with the viscosity data, are not in agreement with the sp. heats of the gases. A mol. composed of atoms rigidly attached to a line should have a ratio of sp. heats of 1.400.  $\text{CO}_2$  and  $\text{N}_2\text{O}$  are assumed to have 3 atoms in line. The value of  $C_p/C_v$  for these gases is of the order 1.300. If N consisted of mols. as pictured by Langmuir the ratio of sp. heats would be 1.667. The value of  $C_p/C_v$  for N is 1.40. A. O. RANKINE. *Imperial Coll. Sci. Tech. Ibid* 107, 203(1921).—Langmuir's proposed structure for the N mol. is not spherically symmetrical in the same sense as are the atoms of the inert gases. There are 2 separate massive nuclei instead of one and this involves the possibility of rotational internal energy of the same type as in the O mol. so that the ratio of the principal sp. heats could not be expected to be as high as 1.667. W. H. ROSS

**Proximity of atoms in gaseous molecules.** A. O. RANKINE. *Proc. Roy. Soc. (London)* 98A, 360-9(1921).—Comparing Bragg's estimates (*C. A.* 14, 3584), based on X-ray crystal measurements, of the diam.,  $2d$ , of the atoms of the rare gases, with the values,  $2\sigma$ , calcd. from viscosity measurements by S. Chapman (*C. A.* 10, 2821), it is found that the ratio  $K = d/\sigma$  varies from 0.553 in the case of neon to 0.769 in that of xenon. On the basis of the Lewis-Langmuir theory the mol. of O consists of 2 Ne atoms with their outer shells sharing 4 electrons in common, while the Cl mol. consists of 2 A atoms which share 2 electrons in common. Br and I are related in a similar manner to Kr and Xe, resp. These mols. are not spherical, but the centers of the 2 atoms are sepd. by the distance  $2d$ , that is, the diam. of the outer electron shell of each atom. The "kinetic theory" radius,  $\sigma$ , of each atom being greater than  $d$ , a certain fraction of



the vol. of each atom is held in common and the resultant shape of the mol. is therefore a sort of shrunken dumb-bell. It is also possible that such a diat. mol. has the shape of an ellipsoid of revolution with its longer axis coincident with the line joining the centers of the atoms. R. calcs. the mean area,  $A$ , presented by such a mol. for all possible orientations, in terms of  $\pi\sigma^2$  for the individual atoms. A comparison of the values thus calcd. with those derived from viscosity measurements shows good agreement, the max. difference being only 6%. The conclusion is drawn that "the Lewis-Langmuir mol. theory accounts satisfactorily for the kinetic behavior of the mols. of  $O_2$ ,  $Cl_2$ ,  $Br_2$  and  $I_2$  in relation to the behavior of the corresponding inert atoms, Ne, Ar, Kr and Xe." The failure of these considerations when applied to N gives negative evidence according to R. that this mol. does not resemble 2 linked Ne atoms, a conclusion which is also in agreement with Langmuir's theory. SAUL DUSHMAN

**The disintegration of elements by  $\alpha$ -particles.** E. RUTHERFORD AND J. CHADWICK. Cavendish Lab. *Nature* 107, 41(1921).—Exptl. evidence has been obtained which shows that the H atoms set in motion by the collisions of  $\alpha$ -particles with N have a greater range than the H atoms from H, the ratio being about 1.4 to 1, which shows that the results obtained with N can not possibly arise from any H contamination. Long range particles are also liberated from B, F, Na, Al and P. The max. range of the particles from these elements is at least 40 cm., that from Al being not less than 80 cm. It is thought that the particles are in reality H atoms liberated at different speeds from the elements. No effect was observed in "pure" elements the at. mass of which is given by  $4n$  where  $n$  is a whole number, nor from any element of mass greater than 31. The effect is however marked in many of the elements the mass of which is given by  $4n + 2$  or  $4n + 3$ . Such a result is to be anticipated if atoms of the  $4n$  type are built up of stable He nuclei, and those of the  $4n + 2$  type of He and H nuclei.

W. H. ROSS

**Polarization of Bohr radiation.** A. RUBINOWICZ. Vienna. *Z. Physik* 4, 343-6 (1921).—By further consideration of the conservation of energy and angular momentum in the system Bohr atom + radiated electromagnetic field R. shows that the radiation can be only circularly and linearly polarized, never elliptically. F. C. HÖRR

**Isotopes: their number and their classification.** WILLIAM D. HARKINS. *Nature* 107, 202-3(1921).—The predilection of atoms for the number 2 is remarkable: e. g., the number of negative electrons and of positive electrons or H nuclei in the nuclei of atoms is almost always even. Elements of even atomic number have more isotopes than those of odd. Most atomic nuclei have the formula  $(p/e)M$  and for such atoms  $M$  is almost always even. The isotopic number is the number which, when added to twice the at. number, gives the at. wt. Isotopic numbers go through maxima and minima when considered from the standpoint of abundance. MARIE FARNSWORTH

**The atomic volume of isotopes.** FREDERICK SODDY. *Nature* 107, 41-2(1921).—From a comparative study of the values that have been obtained for the densities and at. wts. of the various isotopes of Pb, it is concluded that their at. vols. cannot differ by so much as 3 parts in 10,000 and the at. diams. by so much as 1 part in 10,000.

W. H. ROSS

**Experiments on the electron emission from hot bodies.** SIH LING YING. *Proc. Roy. Soc. (London)* 98A, 374-94(1921).—In the case of the anode and cathode forming parallel planes the current  $i$  which flows against a retarding voltage,  $V$ , depends only on the normal velocity component, and if Maxwell's distribution law holds valid,

$$i = i_0 \exp\left(-\frac{Ve}{kT}\right) \text{ where } i_0 \text{ is the current for } V = 0, \text{ and } e, k, \text{ and } T \text{ have their usual}$$

signification. The formula for the case of a hot wire of circular section in a concentric cylinder has been derived by Schottky (*C. A.* 8, 3747). The present expts. were

carried out with the object of testing these relations. In order to eliminate errors due to voltage drop along the filament, a rotating commutator arrangement was used. Wires of W, Pt, and Pt coated with BaO and SrO were used. Extreme precautions were taken to secure a high vacuum. Values of  $\log i/i_0$  were plotted against those of  $Ve/kT$ , and in practically all cases, a straight line was obtained with a slope having only about half the value required on the assumption that the velocities of the emitted electrons are distributed in accordance with Maxwell's law, *i. e.* with an actual velocity distribution corresponding to a temp. about twice as high as the observed temp. Numerous hysteresis effects were observed in these expts., for which the author is unable to offer any satisfactory explanation.

SAUL DUSHMAN

**Secondary electron emission from copper.** I. GARNETT BARBER. Univ. Chicago. *Phys. Rev.* 17, 322–38(1921).—The current flowing to the bombarded plate was measured as a function of the grid potential at low enough pressures to eliminate the ionization effect. The coeff. of secondary emission was found to increase somewhat with the energy up to 500 v. but never exceeded 1.5 v. per electron. Heat-treating the plate increased the coeff. while an increase in temp. greatly decreased it. The energy of the secondary electrons was always less than equiv. to a fall through 5 v., although owing to the roughness of the plate an accelerating potential of about 10 v. was required to release most of the secondary electrons from the plate. The secondary electrons are not reflected electrons because their max. energy is always less than the energy of the primary rays and because of the shapes of the curves obtained. F. O. A.

**The chemical effects of alpha radiation.** E. WOURTZEL. Lab. of Radiology, Paris. *J. phys. radium* 2, 53–61(1921); cf. *C. A.* 15, 626.—No new exptl. data are presented in this paper, which is devoted to the consideration and comparison of the results of Scheuer (*C. A.* 8, 3394) and of Lind (*C. A.* 13, 1183) according to formulas developed by W. (*C. A.* 14, 3588). It is shown that when the chem. effect ( $K$ ) takes place under such conditions that more than 50% of the max. effect possible ( $K\infty$ ) is produced from

a given amt. of Ra Em, the formula  $\frac{K}{\lambda} = \frac{K\infty}{\lambda} (1 - \frac{C}{Rp})$  is applicable, in which  $\lambda$  is the decay const.,  $C$  a reaction const.,  $R$  the radius of the spherical reaction vessel, and  $p$  the gas pressure. But when  $K$  is less than  $K\infty/2$ , the formula takes the form:

$\frac{K}{\lambda} = \frac{C}{Rp}$ , which is a straight line passing through the origin of the coördinate  $\frac{K}{\lambda}$

and  $Rp$ . The exptl. evidence supporting the latter formula is much more abundant than in the case of the former one. W. announces that there is no essential difference between his views regarding the decompn. of  $H_2S$  by  $\alpha$ -particles and those of Debiene (*C. A.* 9, 1147) except that he (W.) does not assume decompn. by collision of  $H_2S$  mols. with those already struck by an  $\alpha$ -particle; that is, W. assumes the entire decompn. to be due to primary action of the  $\alpha$ -particle. S. C. LIND

**The supposed weight and ultimate fate of radiation.** OLIVER LODGE. *Phil. Mag.* 41, 549–57(1921).—A mathematical and speculative paper assuming light to have mass subject to gravity. One of the consequences is that a body with sufficiently concd. mass would be able to trap light and prevent its escaping. Such a body might be a stellar system of exceedingly porous character. It is calcd. that a system able to retain its light would have to have a d. and size of the order  $1.6 \times 10^{17}$  c. g. s. It is hardly feasible for a single mass to satisfy this, as either the mass or the size would be too enormous. To satisfy the condition the earth would have to be squeezed into a sphere of about 1 cm. diam. The treatment of light as a gas of the d.  $10^{-28}$  g. per cc. is also discussed but it is concluded that it appears erroneous to consider light as having wt. or being subject to Newtonian considerations. The trapping of light by a relativity method is dealt with without the assumption of mass. The formation of

electrons from arrested light energy is also discussed in connection with the ultimate fate of radiation and the creation of matter. Barlow suggests that the kind of absorption considered is not different from ordinary absorption, and puts the question whether the particle liberated by an X or  $\alpha$ -ray is really liberated or manifd. S. C. LIND

The attainment of saturation currents for  $\alpha$ -rays in plate condensers. HILDA FONOVITS. *Sitzb. Akad. Wiss., Wien* 128, 11a, 761-93(1919); *Science Abstracts* 23A, 511-2. —It is well known that satn. is much more difficult to attain for  $\alpha$ -rays than for more penetrating radiations. The explanation of this lies in the marked difference in the ionization effects, the "columnar" ionization produced by  $\alpha$ -rays being much more dense than the relatively feeble ionization produced by  $\beta$ - or  $\gamma$ -rays. F. now describes a detailed investigation of the factors necessary to obtain  $\alpha$ -ray satn. Satn. curves for Po in a plate condenser are given under a wide variety of conditions. Thus the intensity of the Po source is varied to give a range of currents 1 to 2400 e.s. units, and the distance apart of the plates varied from 4 to 9 cm. E. J. C.

Theory of the scattering of  $\alpha$ -particles at small angles. W. BORNE. Charlottenburg. *Z. Physik* 4, 300-14(1921).—B. shows that the Gauss law of errors can hold only to a first approximation for the deflection of  $\alpha$ -particles at small angles. For heavy atoms and not too slow particles the theory confirms the measurements of Geiger. For light atoms the results for heavy atoms must be multiplied by  $\sqrt{1+N^{-1}}$  ( $N$  = at. no.). Formulas are also developed for a Bohr He atom. F. C. HOYT

The constitution of cathode rays in the Coolidge tube. V. POLARA. *Atti accad. Lincei* 28, ii, 73-8(1919); *Science Abstracts* 23A, 470.—A theoretical discussion of the nature of the cathode rays in the Coolidge tube. E. J. C.

Spectral analytical observations of canal and cathode rays in the positive point discharge in oxygen and nitrogen. ALBERT SCHULTZ. Univ. Greifswald. *Ann. Physik* 64, 367-76(1921).—Using the app. described by M. Weth (*C. A.* 14, 3182) the spectrum of the positive discharge in O was found to contain spark lines, series lines, doublets of the second arc spectrum, the first arc spectrum and ozone bands. In N the point discharge was found to contain negative and positive bands and spark lines. In the positive point discharge there are slow and fast cathode rays and slow canal rays. To these there correspond 2 regions of ionization. The distribution of the intensity of the observed lines is explained on a basis of certain assumptions. In O the series lines are excited by singly charged atomions and the spark lines by doubly charged atomions. In N the negative bands are excited by doubly charged diatomic mol. ion ( $N_2^{++}$ ) and the positive bands by singly charged diatomic molecule ion. In the canal rays the ion  $O^{++}$  is partly discharged to  $O^+$  and  $N_2^{++}$  to  $N_2^+$ . F. O. A.

The charge distribution in canal rays. A. RÜTTENAUER. Freiburg i. Br. *Z. Physik* 4, 267-88(1921).—R. measures the ratio  $w$  of the positively charged part of a canal ray to the neutral part, by comparing the effect produced by the total beam falling on a thermoclement and by the neutral part after the separation of the positive part by an elec. field. For Hg, H, and  $H_2$  rays in  $H_2$  and H,  $H_2$ , and O rays in  $O_2$ ;  $w$  depends on the square of the velocity and slightly on the pressure of the stationary gas. The mean free path  $\lambda_p$  between ionizations is found by Wien's method (*Sitzb. preuss. Akad. Wiss.* 1911, 773-80; cf. *C. A.* 7, 2007).  $\lambda_p$  depends on the pressure in general agreement with the results of Koenisberger and Kutschewski (*C. A.* 7, 2154) but is independent of the intensity of the ray. F. C. HOYT

Calculation of the influence of free ions on the charge distribution in canal rays. J. KOENIGSBERGER. Freiburg i. Br. *Z. Physik* 4, 284-7(1921).—K. deduces from kinetic theory that the distribution of charge in canal rays is independent of the presence of free ions and electrons up to a pressure of about  $10^{-3}$  mm. Exptl. proof of this is found in the result of Rüttenauer (cf. preceding abstr.) that  $\lambda_p$  is independent of intensity of the ray. F. C. HOYT

**The spectrum of hydrogen positive rays.** L. VEGARD. Univ. of Christiania. *Phil. Mag.* 41, 558-66(1921).—Thomson's (*C. A.* 14, 3579) conclusion that the positive rays of  $H_2$  in the mol. state give rise to the secondary spectrum of the gas is questioned by V., who seeks to interpret T.'s results in another way. The fact that no one has observed a Doppler effect for the secondary  $H_2$  spectrum convinces V. of the incorrectness of T.'s claim. V. attributes T.'s results to changes in the ratio of the "moved" and "unmoved" spectra brought about by changes in pressure or voltage. V. presents new exptl. data to show that the "moved intensity" is emitted from the rays in the neutral state, not from ions. Some intensity may be produced by the neutralization of positive rays, but this should be small compared with that from bombardments of mols. by neutral rays. S. C. LIND

**The spectrum of hydrogen positive rays.** G. P. THOMSON. *Phil. Mag.* 41, 566-9 (1921).—T. replies to the criticism of Vegard (cf. preceding abstract) claiming that the effect of pressure is in the wrong direction to satisfy V.'s contention. V.'s observations can be explained on T.'s theory. V.'s small tubes may be responsible for his observations. T. accepts the conclusion that light is emitted both when the positively charged atom is neutralized and when it collides with gas mols. S. C. L.

**The action of Röntgen rays on iodoform-chloroform solutions.** L. BAUMEISTER and R. GLOCKER. Stuttgart. *Z. physik. Chem.* 97, 368-75(1921).—It has been found that the amount of I liberated from  $CHI_3$ - $CHCl_3$  solns. under the action of Röntgen rays is in no way proportional to the radiant energy, as had been previously supposed. Only the separation of the I from soln. is influenced by the Röntgen rays; by far the greatest part of the I set free from  $CHI_3$  depends on a secondary reaction, the velocity of which is wholly independent of the quantity and quality of the Röntgen rays. In view of this it is impossible to utilize the liberated I for the measurement of the energy of the radiation. H. JERMAIN CREIGHTON

**Does an accelerated electron necessarily radiate on the classical theory.** S. R. MILNER. *Phil. Mag.* 41, 405-19(1921).—A type of accelerated electronic motion is discussed which is shown to lose no energy to electromagnetic radiation when studied under certain circumstances. This case of motion is, however, shown not to represent a "real case of electronic motion." In the light of this analysis M. examines the proof given by Larmor, and Lorenz, which shows that the presence of radiation is a necessary accompaniment to accelerated motion. This examination shows that "the only radiation which the solution gives is strictly speaking not from the electron at all but is to be attributed ultimately to the moving boundary which is postulated to be the limit of the field." He next considers the question as to whether the above mentioned boundary is essential or not. The conclusion is that it might be possible so physically to interpret the facts as to "permit other boundary conditions than those of a simple moving boundary to be applicable for the representation of the real motions."

L. B. LOEB

**The radioelements and their applications.** MME. P. CURIE. *Rev. sci.* 58, 600-19 (1920).—A review, covering the history of radioactivity, nature of the rays, chemistry of the radioelements and their uses in industry and in therapy. G. L. W.

**Multiple table for calculations in radioactivity.** V. L. MEAURIO. *Anales soc. quim. Argentina* 6, 500-10(1918).—Presents a table in which the emanation accumulated per gram of radium in solution is given by convenient steps from 1 hour to 30 days both in curies and mches as units. Several simple problems are rapidly solved by its aid. A supplementary table gives the relation between various radioactivity units. C. S. BRAININ

**Notes on the lectures on radioactivity given at the Lisbon Institute of Technology.** GIOVANNI CONSTANZO. *Rev. chim. applicada* 4, 206-29(1919).—A review. L. E. GILSON

**Radioactivity of mesothorium and its derivatives.** GABRIEL PETIT. *Presse med.* 29, 203-4(1921). A review.

**Gamma rays and the emission of heat from radium and mesothorium.** MMG. P. CURIE. *Compt. rend.* 172, 1022-5(1921).—Ra and Meso-Th may better be distinguished not only on basis of  $\gamma$  rays but also on basis of heat produced. An equation is developed for detg. the ratio of Meso-Th to Ra and a method is given for detg. the age of the prepn.

**The isotopy of radium A and of polonium.** MLLK. A. MUSZKAT AND H. HERSZ-FINKIEL. Lab. of Radiology, Sci. Soc., Warsaw. *J. phys. radium* 2, 15-18(1921).—The examn. of the isotopism of a pair of elements, of which both are radioactive with fairly short periods, presents especial difficulties, since gravimetric methods are available in neither case. Radioactive analysis must be resorted to for both elements. In the present work a soln. of polonium was prepd. by dissolving it from the walls of a vessel in which Ra Em had been enclosed for long periods. Ra A was dissolved in the same soln. by treating the walls of a glass container exposed for 15 min. to large quantities of emanation. Po and Ra A were detd. by means of their  $\alpha$  radiation, Ra A by extrapolation to 0 time after successive measurements soon after prepn., Po on the following day when all Ra A had decayed. Electrolytic sepn. was attempted by dipping different metal electrode pairs into the soln. for 25 secs. The metal pairs used were Au-Ag, Ni-Pt, and Au-Cu. The ratio of Po:Ra A was found in all cases to be unchanged by electrodeposition, thus demonstrating their isotopism; while the proportion of Po:Ra B and Po:Ra C did not show any constancy under the same treatment. Comparison of the volatility of Po and of Ra A showed it to be identical for the two isotopes, much less than that of Ra B, and much more than that of Ra C.

S. C. LIND

**The mass of long-range particles from thorium C.** SIR E. RUTHERFORD. Univ. of Cambridge. *Phil. Mag.* 41, 570-4(1921).—Besides the 2 sets of  $\alpha$ -particles emitted from Th C, one with range of 5.0 cm., and the other with 8.6 cm., it has been known for some time that a small number (about 1 in 10,000) have a still longer range, 11.3 cm. It was, therefore, of interest to see if these long-range  $\alpha$ -particles might be due to disruption of O of the mica screen employed, which appeared improbable as the number of scintillations observed was about ten times larger than would be expected from that cause. The expts. were repeated using Al screening. The results show that the long-range  $\alpha$ -particles from Th C are emitted from the source and are not a secondary product of bombardment. The exact mode of their emission is doubtful, but assuming them to come directly from Th C, an isotope of Tl would result having at. wt. 208 instead of 206. On this theory the amt. of Tl to be expected would be 10 mg. for each 100 g. of Th-Pb. Some Tl has been found in Th minerals. It will be of interest to det. if the amt. is that predicted. Incidentally it was shown that the mass of  $\alpha$ -particles emitted by Th C is 4 and not 3. There is no evidence to support the emission of He atoms of mass 3, nor of swift H atoms by any radioactive substances. S. C. LIND

**Long-range particles from thorium active deposit.** A. B. WOOD. Cambridge Univ. *Phil. Mag.* 41, 575-84(1921).—A description of the exptl. details of the investigation of the long-range particles from Th C referred to in the foregoing abstract. A strong source of Radio-Th was deposited on the flat tip of a Cu wire, above which were placed the mica or Al screens between the source and the ZnS screen. Two methods were employed: (1) To vary the position of the mica screen, which variation failed to change the number of scintillations to be expected if they were due to particles bombarded from the mica; (2) to employ Al instead of mica screens. The number of scintillations was slightly greater with mica, indicating that perhaps 7 to 8% were due to the mica, the rest coming directly from the source. The following numerical relations have been found regarding the number of particles of different types: (1)

Number of long-range particles (probably  $\alpha$ -rays) relative to the total number of  $\alpha$ -particles, 1 in  $10^4$  approx.; (2) relative number of high velocity O atoms produced by collision of  $\alpha$ -particles with mica, 1 in  $10^2$  approx.; (3) relative number of particles of range exceeding 11.3 cm. (probably swift H atoms), 1 in  $10^4$  approx. (2) and (3) are stated to be only rough estimates based on scant evidence. S. C. LIND

Slow variations in the  $\beta$ -radiation from radium preparations. F. LERCH. *Sitzb. Akad. Wiss., Wien*, 128, II, 635-8(1919); *Science Abstracts* 23A, 513.—Discusses some apparent changes of  $\beta$ -activity observed when Ra preps. are treated chemically. H. G.

Hard secondary radiation from the  $\gamma$ -rays from radium. K. W. F. KOHLRAUSCH. *Sitzb. Akad. Wiss., Wien* 128, IIa, 853-95(1919); *Science Abstracts* 23A, 513; cf. C. A. 14, 147.—The secondary radiations produced when Ra  $\gamma$ -rays are incident on matter are very complex. The observations now described refer in particular to the two components  $S_1$  and  $S_2$ . The hard  $S_1$  rays produce the  $K_1$ -radiation, and the  $S_2$  rays the  $K_2$ -radiation. The absorption and scattering coeffs. for these characteristic radiations have been detd. The theoretical bearing of the exptl. results is discussed, particular reference being made to Debye's theory. H. G.

The branching ratios of Ra C, Act C, Th C; and the decay constants of the C' products. E. ALBRECHT. *Sitzb. Akad. Wiss., Wien* 128, IIa, 925-44(1919); *Science Abstracts* 23A, 512.—The "half-value" periods of the C' products (isotopic with Th) of the 3 radioactive series have been measured, with the following results:

Act C' . . . . . T = 4.76 mins.,  $\lambda = 2.43 \times 10^{-3}$  sec. $^{-1}$

Th C' . . . . . T = 3.20 mins.,  $\lambda = 3.61 \times 10^{-3}$  sec. $^{-1}$

Ra C' . . . . . T = 1.32 mins.,  $\lambda = 8.7 \times 10^{-3}$  sec. $^{-1}$

Assuming the branching ratio obtained by Marsden, Darwin, and Barratt for Th C, namely Th C' / Th C = 0.35, to be correct, the ratios for Act and Ra are found to be as follows:

Act . . . . . C'/C = 99.84

Ra . . . . . C'/C = 0.0004

Observations with Ra C' have demonstrated the phenomenon of aggregate recoil referred to by R. W. Lawson [cf. following abst.] E. J. C.

Aggregate recoil accompanying the decay of substances emitting  $\alpha$ -rays. R. W. LAWSON. *Sitzb. Akad. Wiss., Wien* 128, IIa, 795-830(1920); *Science Abstracts* 23A, 512-3.—If Po is deposited by electrolysis on a clean metal foil it is found subsequently that, at normal pressures and *in vacuo*, surrounding objects become active also. The phenomenon can be explained on the supposition that aggregates of Po atoms are carried off from the active surface and deposited on neighboring surfaces. When an  $\alpha$ -particle is ejected from such an aggregate in the direction of the active plate an equal and opposite momentum to that of the  $\alpha$ -particle is imparted to the aggregate which may consequently leave the active surface and become deposited elsewhere. This phenomenon is termed "aggregate recoil." As a result of this type of recoil it is almost impossible to obtain a pure deposit of any decay product by a process of  $\alpha$ -ray recoil. It is found that the quantity recoiling from Po in this manner, in "aggregates," is from 10 to 20 times as great as the quantity recoiling at normal pressure. For relatively short exposures the total aggregate recoil from Po is proportional to the time. For longer exposures the relation is not so simple and irregularities are more frequently observed. The phenomenon has been carefully observed when the Po was deposited on different metal surfaces, as, for example, on Pt, Au, and Pd. It was observed that the percentage loss, by "aggregate" recoil, per day in all cases diminished with time, the rate of loss being greater from the noble metals than from surfaces of the commoner

metals. Thus from typical noble metals the rate of loss diminished to half its initial value in 7 to 12 days. For the more easily oxidizable metals this "half-value" time of the aggregate recoil was considerably greater, this difference being explained on the assumption that the aggregates are prevented from leaving the surface by a superficial oxide layer. The rate of loss was much greater *in vacuo* than at normal pressures. Thus the period of Po *in vacuo* appeared to be 59.6 days, instead of 136.5 days observed at normal pressures. This result indicates the importance of considering the effect of aggregate recoil when making a detn. of the decay period of a radioactive substance. It is now shown that the apparent period is affected by many factors, among which the following have been studied: (1) Surface on which the substance is deposited. (2) Length of time active substance has been on the surface. (3) Pressure of gas in which observations of decay are made. (4) Conc. of active deposit. H. G.

**Experimental method of drawing directly the decay curve of a radioactive composition.** A. PICCARD. *Arch. sci. phys. nat.* 2, 262-3 (1920); *Science Abstracts* 23A, 510.—Paper read before the Soc. Suisse de Physique.—P. describes a simple method for detg. the decay curve of a radioactive substance of short life, when it is difficult to det. the period by ordinary means. The fiber of an Elster and Geitel electrometer is projected on a screen, its position being marked as it descends under the action of the radioactive material. A second fiber is projected on the same screen, in this case the rate of movement being uniform, whereas before the rate of movement diminished with time as the radioactive product decayed. The position of the point of intersection of the two traces can be marked and the exponential curve deduced at once from the known rate of the fiber moving at const. speed. E. J. C.

**Measurements with Ra F in a guard-ring plate condenser.** G. RICHTER. *Sitzb. Akad. Wiss., Wien* 128, IIa, 539-69 (1919); *Science Abstracts* 23A, 513.—Observations have been made by Mache and Flamm (C. A. 8, 1386, 2649, 3531) on the relation between distance apart of plates and satn. current, using a guard-ring plate condenser. In their expts. certain differences were noticed between the theoretical and observed values. The object of the present expts. was to det., if possible, the cause of the discrepancies. Three formulas for ionization by  $\alpha$ -particles were examd., namely: Geiger's, Flamm's, and Lawson's. The exptl. results supported the formula given by Geiger:  $f(\rho) = 1/(r - \rho)^{3/2}$ , where  $f(\rho)$  is the ionization per cm. path of the  $\alpha$ -particles at a distance  $\rho$ , and  $r$  the range of the  $\alpha$ -particles. E. J. C.

**The physical nature of X-rays.** M. BORN. *Umschau* 25, 29-32 (1921).—A review. F. O. A.

**Theory of X-ray spectra.** A. SMEKAL. *Sitzb. Akad. Wiss., Wien* 128, IIa, 639-76, (1919); *Science Abstracts* 23A, 509; cf. C. A. 15, 337.—This paper deals mainly with the question of the arrangement of electrons in the atom. The treatment is mathematical and does not permit of a short abstract. E. J. C.

**The continuous X-ray spectrum.** HERMANN BEHNKEN. *Z. Physik* 4, 241-53 (1921); cf. C. A. 15, 467.—B. obtains a formula having a theoretical basis, that fits the data of Ulrey (C. A. 12, 1530) for energy distribution in the X-ray spectrum at const. voltage. The form of the curves suggests that near the high frequency limit where absorption in the anticathode is small,  $E_\nu = \text{const.}/\nu^2$ . This and the assumption that the loss in potential on penetration of the electrons into the anticathode without quantum

impacts is proportional to the penetration leads to the equation  $\frac{E_\nu \nu^2}{c} = Q \nu^{2.4} [1 -$

$e - \frac{(q \nu_0 - \nu)}{\nu^{2.4}}]$  where  $\nu_0 \times 10^{14}$  is the max. frequency, and  $Q$  and  $q$  are const. Absorp-

tion in the glass of the X-ray tube can readily be allowed for. The formula is applied to find the distribution for a sinusoidal voltage. F. C. HORT

**Precision measurements in the X-ray spectra. IV. K-series, the elements copper-sodium.** ELIS HJALMAR. Univ. of Lund. *Phil. Mag.* 41, 675-81(1921); cf. C. A. 15, 1101.—A continuation of the work of Siegbahn (C. A. 13, 2634), employing the same app. and method, in which the  $K\alpha_1$  line was detd. in the region Cu—Cl. The investigation is now extended to (1) the K  $\beta_1$  line for Cu—Cl, and (2) to the  $K\alpha_1$  and  $K\beta_1$  lines for S—Na. In (1) calcite and in (2) gypsum was employed as the analyzing crystal. The wave-lengths using calcite are given for the elements Cu, Ni, Co, V, Ti, Se, Ca, K, and Cl. The  $\beta_1$  component  $\beta'$  was observed for Ni, Co, V, and Ti. The  $\beta''$  component was observed for Ca, K, and Cl. The lattice const. for gypsum has been redetd. and the deviations are discussed. The final value adopted is:  $\log 2d = 1.1805620-8 (\pm 0.0000149)$ . The  $\alpha$  and  $\beta$  lines are given for S, P, Si, Al, Mg, and Na. Some new faint lines  $\alpha'_1$ ,  $\alpha_2$ ,  $\alpha_3$ ,  $\beta'_1$ , and  $\beta_2$  were discovered. A diagram is given showing the complete K-spectrum. No element exhibits all the lines. S. C. LIND

**The mass absorption and mass scattering coefficients for homogeneous X-rays of wave length between 0.13 and 1.05 Ångström units in water, lithium, carbon, nitrogen, oxygen, aluminium, and iron.** C. W. HIGLETT. *Phys. Rev.* 17, 284-301(1921).—The presentation of the new exptl. work is preceded by a discussion of the current views of the mechanism of absorption and scattering. The total absorption coeff. of homogeneous X-rays, obtained by means of a Bragg spectrometer, was measured for the above-named materials at various wave lengths as stated. The total mass absorption coeff. was found to be proportional to the cube of the wave length over certain regions but in all cases where the above range was entirely covered, the const. of proportionality differed for different ranges of wave length. The case of H seems to be an exception as its total mass coeff. was found proportional to the  $9/2$  power of the wave length. This, however, was obtained by combining the results from  $H_2O$  and liquid O. The const. which multiplies the cube of the wave length to give the true mass absorption coeff. is found to be approx. proportional to the cube of the at. no. of the absorbing element, except for Li, indicating that Moseley's law does not hold for Li. The true mass absorption coeff. for Fe is apparently not proportional to the cube of the wave length between 0.70 and 1.05 Å. U. For other elements with wave lengths less than 0.20 Å. U., these coeffs. are smaller than is to be expected from theory if the electron has a diam. of the order of  $10^{-12}$  cm. The lack of this decrease in the coeffs. of Fe is attributed to a shrinkage in the diameter of the electrons in the atoms on account of a closer packing of the electrons. The mass scattering coeff. of all the materials studied is less than that given by Thomson's theory. For H it is approx. twice that for other elements, which is further evidence that H has twice as many scattering electrons per unit of mass than other elements. For Fe this coeff. apparently increases for wave lengths longer than 0.70 Å. U. S. C. BRAININ

**An arrangement of Seemann's "knife-edge spectrograph" for precision wave length measurements (of X-ray spectra).** WILHELM VOGEL. Bonn. *Z. Physik* 4, 257-61 (1921).—This spectrograph (cf. C. A. 10, 2437) is well adapted for precise measurements of X-ray wave lengths as it requires only a very small crystal surface and the results can be made to depend on linear measurements only. Crystal and knife-edge are rotated through exactly  $180^\circ$  by a telescope and mirror method and from the interval between the two reflected lines the wave length, in terms of the lattice constant of the crystal, can be calculated. Measurements (relative to Siegbahn's value for Pt  $L\alpha_1$ ) are made to 0.01% for Pt  $L\beta_1$  and  $L\gamma_1$ . F. C. HORT

**Improvements in Seemann's "knife-edge spectrograph" as used for precision measurements.** ANTON WEBER. *Z. Physik* 4, 360-2(1921).—W. discusses a method for the exact adjustments of the crystal in front of the knife-edge. Cf. preceding abstract. F. C. HORT

**Spectroscopy.** A. FOWLER. *Engineering* 111, 265-6(1921); cf. C. A. 15, 1459.—



The concluding lecture deals with applications of the Bohr theory to the analysis of stellar and solar spectra. The ratio of mass of H nucleus to that of an electron is deduced from purely spectroscopic data as  $1836 \pm 12$ . The relation of arc and spark spectra is discussed on the basis of the "shift principle" and the appearance of only enhanced lines of Sr and Ba in the sun is explained by the complete ionization of these elements. Ca has a higher ionizing-potential and is, therefore, only partially ionized in the sun, showing both the arc spectrum and the enhanced lines. There is no reason to believe that the compn. of the sun and stars is different from that of the earth. Although different stars give markedly different spectra many of these differences can now be accounted for by physical conditions in the stars. W. F. MEGGERS

**Spectroscopy in the visible and ultra-violet spectrum.** T. R. MERTON. *Proc. Roy. Soc. (London)* 99A, 78-84(1921).—The use of a neutral wedge for the detn. both of photographic and absolute intensities of spectrum lines (*Trans. Roy. Soc. (London)* 217A, 237(1917); cf. *C. A.* 11, 555) is limited in application, being inapplicable in the ultra-violet to 2000 Å on account of complete opacity and requiring special precautions to obtain on the spectrograph slit uniform illumination from small sources of light. M. proposes a new method which substitutes for the neutral wedge a coarse grating (ruled 25 lines per inch on quartz covered with lamp black) which is inserted between the prism and the camera lens of the spectrograph with the rulings perpendicular to the refracting edge of the prism. With the slit length reduced to a small value a discontinuous spectrum consists of dots of different intensities (orders of spectra) on either side of a strong central dot. Calibration of this method is outlined so that either relative or absolute intensities may be found from the visibility of the last dot. An application to stellar spectroscopy is suggested since the stars themselves provide the parallel rays which are produced in the laboratory by means of the collimator with the slit reduced to a pin hole, and it is only necessary to interpose a suitable grating between astronomical objective prisms and objective to measure the spectral emission. W. F. MEGGERS

**A mechanical theory of series spectra. III. Vibration periods of X-rays and atomic weight.** A. KORN. *Physik. Z.* 22, 148-50(1921).—In the preceding articles (*C. A.* 14, 3368) the production of the radiations comprising ordinary line series was ascribed to small vibrations of 2 elec. particles, of masses  $m$  and  $m_0$ , superimposed on a steady circular motion of  $m$  about  $m_0$  in a compressible medium. In the present article the production of X-rays is ascribed to additional negative particles circling  $m_0$  much more rapidly and at a much smaller distance than  $m$ . For such rapid vibrations the medium can be considered practically incompressible, and the paths of the encircling particles are given by  $f(r) = \{(a/r^2) + (b/r^3) + \dots\}mm_0$ . If now any external disturbance acts on such a particle there will be superimposed on the circular path a vibration having, as a first approximation, a period equal to the frequency of revolution, and using only the  $a/r^2$  term in  $f(r)$ ; this leads to a period varying as  $1/m_0^2$ , where  $m_0$  is approx. the at. wt. To account for the multiplicity of X-rays in each element it is necessary to use the full expression for  $f(r)$ . This will be considered in a later article. R. T. BIRGE

**The Balmer series of hydrogen, and the quantum theory of line spectra.** RAYMOND T. BIRGE. *Phys. Rev.* 17, 589-607(1921).—To make as accurate a comparison as possible between the best exptl. results for the Balmer series of H and the theoretical results to be expected according to the latest developments of the quantum theory of line spectra, the exptl. data are reviewed and then the quantum theory of line spectra, as applied to the Balmer series, is summarized, beginning with Bohr, who in 1913 deduced the Balmer formula on the hypothesis of atomicity of angular momentum of electrons moving in circular orbits about a nuclear charge. In 1915 Bohr applied relativity mechanics to his at. model, and Sommerfeld in 1916 extended the Bohr

theory to the case of elliptic orbits, thus accounting for the "fine structure" of the spectral lines. This theory was further advanced in 1918 by Bohr who worked out a logical basis for the intensity and state of polarization of the various fine structure lines and Kramers then applied Bohr's ideas to the Stark effect. The fine structure of  $H\alpha$  ( $\lambda = 6563 \text{ \AA.}$ ) consists of 6 lines, two of which are relatively intense, and Birge shows that Merton's measurements (*C. A.* 15, 207) of the sep., half-width and relative intensities of the  $H\alpha$  and  $H\beta$  doublets check with values derived from the recent Bohr-Kramers developments of the quantum theory, if a general field of 100 volts per cm. is assumed. A discussion of spectral formulas for the Balmer series indicates (1) that the Rydberg number is not const. for different lines, (2) that this discrepancy between observed and computed results is somewhat reduced by the application of relativity mechanics, and (3) that the discrepancy is obliterated when account is taken of the fine structure of the lines. The Rydberg const. for H is then calcd. to be  $106,977.7 \pm 0.2$  and the Rydberg spectral series const. for a nucleus of infinite mass is computed to be  $109,736 \pm 0.2$ . A discussion of observations in mixts. of H and He made by Merton and Nicholson (*Proc. Roy. Soc.* 96A, 112(1919); cf. *C. A.* 14, 2444) at relatively high pressures concludes the paper. The well known neutral effect of He on neighboring electrons together with the Maxwellian distribution of velocities, sepns., etc., is quite sufficient to account for the exptl. results thus far obtained. W. F. MEGGERS

**The dispersion of hydrogen in the ultra-violet.** MAX KIRN. *Ann. Physik* 64, 566-76 (1921).—The app. and method used by Traub (*C. A.* 14, 2297) for measuring the dispersion of air to 1854  $\text{\AA.}$  was employed for dispersion measurements in H. The refractivity was found to be  $(n-1)10^6 = 139.65$  for Hg green light 5462  $\text{\AA.}$  Relative to this value 10 other values were obtained for Hg lines to 2302 and for 4 Al spark lines, 1990 to 1854  $\text{\AA.}$  The dispersion is represented by 2 formulas, one of which is as follows:  $(n-1)10^3 = 13610.1866 + 1.0246373 \times 10^{10}\lambda^{-2} + 990606.9 \times 10^{10}\lambda^{-4} + 70.512617 \times 10^{20}\lambda^{-6}$ . The av. error is about 0.04% and the agreement with Koch's values (*C. A.* 7, 2711) is very good. Comparison with a theoretical dispersion curve deduced by Debye from the structure of the H mol. shows that the observations give values from 2% at 5462 to 3% at 1854  $\text{\AA.}$  higher than the theoretical. W. F. MEGGERS

**Some spark spectra in the extreme ultra-violet.** LÉON BLOCH and EUGÈNE BLOCH. *Compt. rend.* 172, 803-5(1921); cf. *C. A.* 15, 340, 632.—The spectrum of zinc is a convenient source for standard wave lengths in the Schumann region and has been used to measure the spectra of several metals such as Pb, Cd, Fe, Co, Au, and Pt. A table of Zn spark lines comprizing 67 wave lengths from 1839.0 to 1443.2  $\text{\AA.}$  is given and is followed by 99 lines in the Cd spectrum, 1844.9 to 1415.9  $\text{\AA.}$  and 10 lines for Pb, 1821.7 to 1406.5  $\text{\AA.}$  W. F. MEGGERS

**Spark spectra of iron and cobalt in the extreme ultra-violet.** LÉON BLOCH and EUGÈNE BLOCH. *Compt. rend.* 172, 851-4(1921).—These spectra are rich in lines in the Schumann region but most of them are faint and difficult to resolve with a prism. 116 Fe lines are presented for the first time between 1844.5 and 1530.3  $\text{\AA.}$  and 143 Co lines from 1845.5 to 1455.6  $\text{\AA.}$  W. F. MEGGERS

**Spark spectra of gold and platinum in extreme ultra-violet.** LÉON BLOCH and EUGÈNE BLOCH. *Compt. rend.* 172, 962-4(1921).—The spark spectrum of Au between the wave length limits 1850.4 and 1401.8  $\text{\AA.}$  comprizes 109 lines. Wave lengths are given to 0.1  $\text{\AA.}$  but errors may be larger. The spectrum of Pt in the Schumann region is given for the first time. 149 lines were found between 1843.0 and 1461.0  $\text{\AA.}$  W. F. MEGGERS

**A model to explain the terms of the sharp subordinate series.** ERWIN SCHRÖDINGER. Stuttgart. *Z. Physik* 4, 347-54(1921).—This series in the optical spectra (s-term) is characterized by a variable term  $n + \frac{1}{2}$ , where  $n$  is an integer. Thus the electron

orbits cannot be even approx. Sommerfeld ellipses. S. shows that if one adopts Lande's view (*C. A.* 15, 462) of a shell of 8 electrons with radius 0.814 that of the first circular orbit in H the next family of orbits must penetrate into this shell. Regarding the inner shell as unaffected he succeeds in quantizing this perturbed motion, giving a series term depending on  $n + 0.26$ .

F. C. HORT

**Absorption spectrum of europium and samarium.** WILHELM PRANDTL. *Z. anorg. allgem. Chem.* 116, 96-101(1921).—In P.'s first paper on the absorption spectrum of Eu (*C. A.* 15, 630) some ultra-violet bands were omitted because they were thought to represent a trace of Sm. Further purification of  $\text{Eu}_2\text{O}_3$  shows that these Eu bands coincide with Sm bands but can be distinguished from the latter since the Sm bands are wide and have diffuse edges while the Eu bands are narrow and sharp. The following bands are added to those given previously for Eu:  $\lambda = 376.2-373.6, 367.2-365.5$  and  $363.7-361.7\mu\mu$ . The absorption maxima for Sm are as follows: 560, 529, 500.7, 479.5, 464, 451.6, 442, 417, 407, 401, 390, 375, 363, 355 and  $345.5\mu\mu$ . Tables and drawings illustrating the appearance of the absorption of Eu and of Sm in various dilns. (0.1 to 20 g. per 100 cc.) are given.

W. F. MCGEES

**Pressure-shifts in a calcium arc.** L. F. MILLER. *Astrophys. J.* 53, 224-30(1921).—By means of a 21-ft. grating spectrograph the pressure shifts in the Ca arc were observed in the region  $\lambda 3150-6500 \text{ \AA}$ . A 4-mm., 4-amp. arc between Ca electrodes, one water-cooled, the other pointed, was operated in a chamber in which the pressure was varied from 5 to 76 cm. of Hg. A table gives the results for 75 lines, accurate to 0.001  $\text{\AA}$ . The H and K lines, and the P and T series, and a few other lines show no appreciable shift. Lines shaded to the violet show a shift in this sense; other lines tend to shift toward the red. The shift is the same for all lines of each term of a series, and increases with the term number. The stable iron lines were used as comparison spectrum.

K. BURNS

**The vacuum arc spectra of sodium and potassium.** SNEHAMOV DATTA. *Proc. Roy. Soc. (London)* 99A, 69-77(1921).—Investigations of spectral series require more accurate measurements of the spectra of the alkali metals, especially in the case of the diffuse series and the higher members of the sharp series. Lamps containing Na or K vapor at low pressure were run on a 200-volt circuit with a current of about 2.5 amperes. The spectra were photographed with a 10-foot concave grating and wavelength measurements were made in international Angstrom units. Six pairs of lines in the sharp series and five pairs in the diffuse series are given for Na and 8 and 7, resp., for K. Four groups of bands were observed in the visible spectrum of Na when the arc was first started. A combination pair for K with  $\lambda = 4642.172$  and  $4641.585 \text{ \AA}$ . was resolved for the first time. The increased accuracy of these wave-length measurements makes it possible to identify Na and K lines in the solar spectrum with greater certainty than heretofore.

W. F. MCGEES

**Sodium vapor electric discharge tube.** F. H. NEWMAN. Univ. College, Exeter. *Proc. Phys. Soc. (London)* 33, II, 70-2(1921).—A simple method of producing a bright source of Na radiation is described. An elec. discharge tube of quartz having a pool of Na-K alloy as one electrode and an iron rod as the other electrode, is utilized. For best results, the alloy is kept at a temp. of  $250^\circ$  to  $300^\circ$ , a ring gas burner being a suitable source of heat. The light from the elec. discharge consists almost entirely of the D lines. When the discharge is passing, the alloy absorbs any gases present in the tube; consequently continuous pumping is not necessary to maintain a good vacuum.

C. C. VAN VOORHES

**Regularities in the absorption of cesium lines, and an example of the determination of vapor pressures by absorption measurements.** CHR. FÜCHTBAUER AND H. BARTHEL. Tübingen. *Z. Physik* 4, 337-42(1921).—F. and B. measure the absorption coeff. of Cs vapor for the Cs doublet 3617 and 3612  $\text{\AA}$ . ( $1.5 S - 5 P$  doublet). The results are

in agreement with the previous generalization of Füchtbauer and Hofmann (*C. A.* 8, 1060): For corresponding doublets of all alkali principle series the intensities for a  $1.5S-mP$  doublet are in the ratio  $1:m$ . The intensities are measured by  $n\omega'$  where  $n$  is the index of refraction,  $\kappa$  the absorption coeff., and  $\gamma'$  the half value frequency.

This has been shown to be proportional to  $\int_0^\infty n\kappa d\nu$  and hence to the Bohr probability

factor,  $\frac{4\pi}{c h N} \int_0^\infty n\kappa d\nu$ . For the lines 3617 and 3612 the intensity ratio (photographically

measured) is 0.500 and for the lines 3877 and 3612 it is 3.69. The proportionality between pressure and absorption coeff. is used to det. the relative vapor pressures of Cs at 4 temps.

F. C. HOYT

The electrodeless discharge in sodium vapor. JOHN K. ROBERTSON. Queen's Univ., Canada. *Nature* 107, 269(1921).—By placing a primary Tesla coil about a highly exhausted pyrex bulb contg. metallic Na and inclosing the whole in an oven, a brilliant electrodeless discharge was obtained in the neighborhood of 300°. Observation with a Hilger const. deviation spectroscope revealed, in addition to the D lines, doublets at 6162, 6158, 5688, 5683, 4667, 4497 as well as faint probable doublets at 5153, 4980 and 4572. After 2 or 3 hrs. continuous heating the discharge was almost as brilliant as initially although the bulb on removal from the oven had the usual brown color resulting from the action of the hot vapor.

W. H. ROSS

Magnetic separation of neon lines and Runge's rule. H. NAGAOKA. Imperial Univ., Tokyo. *Proc. Phys. Soc. (London)* 33, 83-99(1921).—The results of an investigation of the Zeeman effect for Ne lines are given. The departures from Runge's rule are discussed. The discrepancies are attributed to variations of the ratio  $e/m$ .

C. C. VAN VOORHIS

A new thermoelement for spectro-radiometry. W. VORGE. *Physik. Z.* 22, 119-20 (1921); cf. *C. A.* 14, 3195.—This new thermoelement is supplied with a gold-plated spherical mirror which can focus the total energy of a spectral line 25 mm. high and 3.5 mm. wide on a single element. This is found to be much more sensitive and convenient than a 10 element thermopile used without condensing the spectrum, and is recommended in all cases where the selective reflection of the gold mirror is not objectionable.

W. F. MEGGERS

Forces resulting from the radiation of black surfaces. H. SIRK. Vienna. *Z. Physik* 4, 211-20(1921).—On oblique illumination of a blackened surface in air there is shown to be a third force besides light pressure and the radiometer effect, which has a component along the illuminated surface. Its existence is shown experimentally by the production of a rotation of a blackened plate suspended from a quartz fiber when conditions are such as to eliminate the effect of forces perpendicular to the plate (radiometer effects) and forces in the direction of illumination (light pressure). The phenomena can be accounted for by the emission of adsorbed gas.

F. C. HOYT

Measurements with the radiometer. III. WILHELM H. WESTPHAL. Berlin. *Z. Physik* 4, 221-5(1921).—W. describes a new form of radiometer consisting of a thin blackened quartz fiber hanging vertically, and shows that the dependence of deflection on pressure is the same as for the ordinary type. (Cf. I and II, *C. A.* 14, 2750).

F. C. HOYT

Demonstration of the after-glow in active nitrogen by means of the electrodeless ring current. J. ZERNACK. Munich. *Physik. Z.* 22, 102-3(1921).—App. is described for showing the glow in a glass bulb, persisting for 20 to 30 secs. after stopping the current.

G. L. W.

**Photoelectric photometry of the after-glow of active nitrogen.** E. v. ANGERER. Munich. *Physik. Z.* **22**, 97-102(1921).—Using the method of the preceding abstract for obtaining the glow and a sensitive and instantaneously damped photoelec. cell for measuring the intensity of the glow at intervals of one sec., A. shows that the reciprocal of the square root of the intensity of luminescence is proportional to the time. The function is thus not exponential.

G. L. WENDT

**Phosphorescence of zinc sulfide under the action of alpha rays.** H. HERSZFINKIEL AND L. WERTENSTEIN. Lab. Radiology, Warsaw. *J. phys. radium* **2**, 31-2(1921).—The duration of a single scintillation produced by an  $\alpha$ -particle impinging on a ZnS screen has been redetd. The value  $t = 1/9000$  sec. was obtained, considerably longer than  $1/15,000$  obtained by Wood (*Phil. Mag.* [6] **10**, 427(1905)). The spectrum of the light from scintillations and also from phosphorescence after exposure visible to light, ultra-violet light, cathode rays and canal rays, was also examd. All the spectra have a part in common composed of 2 bands with their max. at  $0.556$  and  $0.486\mu$ . In the case of the scintillations the bands are followed by a sort of continuous spectrum continuing to  $0.42\mu$ , which one also finds in the phosphorescent spectra of cathode and canal rays, but which is wholly lacking in the ultra-violet phosphorescence. The large part of the spectrum common to phosphorescence and to scintillation justifies the application to the latter of the idea of luminosity due to the recombination of electrons with the ions. The short duration of scintillation may be partly due to the same effects of concn. by canalization of the particle as are found in the rapid initial recombination of gas ions under  $\alpha$ -radiation, and partly due to a local high temp. effect. The phosphorescence of cathode rays falls in duration between that of  $\alpha$ -rays and the much longer duration of light, which would be expected from the relative ionization and localization of energy.

S. C. LIND

**Raising of the dielectric constant of a zinc phosphor by light.** W. MOLTHAN. Göttingen. *Z. Physik* **4**, 262-6(1921).—The dielec. const. (cf. Gudden and Pohl, *C. A.* **14**, 3362) is found to increase with increasing frequency of the alternating voltage used for measuring the capacity. This increase can be used to estimate the displacement of the electrons and thus the diam. of the mol. complex involved. The results indicate a diam. of the complex which is about ten times that of the mol.

F. C. HOVR

**The optical properties of certain crystals in the long wave infra-red spectrum.** TH. LIEBISCH AND H. RUBENS. *Sitz. preuss. Akad. Wiss.* **1921**, 211-20.—In continuation of expts. previously described (*C. A.* **14**, 1934) the reflecting powers of wurtzite (Zn, Fe, Cd), S, zirkon ( $ZrO_2 \cdot SiO_2$ ), rutile ( $TiO_2$ ), strontianite ( $SrCO_3$ ) and kryolith ( $3NaF + AlF_3$ ) are measured for 10 or 12 different wave lengths between the limits  $22\mu$  and  $300\mu$ , using the "Reststrahlen" from various substances and the very long waves isolated by the quartz lens method. Measurements are made with polarized light and for both the ordinary and extraordinary ray. The results are given in tables and curves and the dielec. coeffs. computed from the reflection data are in satisfactory agreement with the exptl. values in most cases. Transmission measurements were made for wave lengths obtained by the quartz lens method from the Auer burner ( $110\mu$ ) and the Hg lamp ( $300\mu$ ). The samples were about 0.5 mm. thick and the percentages of energy transmitted by the various crystals are tabulated.

W. F. MEGGERS

**Electric conductivity of some crystals and the influence of radiation upon it. II.** W. C. ROENTGEN (partly in cooperation with A. JOFFE). *Ann. Physik* **64**, 1-195(1921); cf. *C. A.* **7**, 3449.—Various expts. at ordinary temp. with NaCl crystals did not prove decidedly whether or not a small elec. cond. (sp. elec. resistance =  $6.10^{13}$  ohm/cm.) was due to secondary influences. Sun-light and ultra-violet rays do not have any effect; but if first exposed to X-rays or  $\gamma$ -rays for a short time, the NaCl crystals show elec. cond. in the light, violet rays having the maximal influence, increasing the cond. about 40000 times. X-radiation alone has only very little influence on the cond.

Colored NaCl crystals need not to be first exposed to X-rays to show elec. cond. under the influence of light. But it could be proven that only absorbed light influences the cond. Similar behavior is shown by KCl and  $\text{CaF}_2$ . The quant. measurements are very difficult, as temp., time and elec. charge change the cond. to a great extent.

EUGENE FIERTZ

**Photoelectric conductivity of crystals.** R. POHL. *Physik. Z.* **21**, 628-30(1920).—A lecture. Diamond crystals in an elec. field of 16000 volt/cm. become conductive for the elec. current if exposed to light, the influence increasing with shorter wave length. Before a crystal can be used again for that expt. it has to be "rearranged," best by exposing to infra-red rays. Impure diamond crystals, ZnS and Hg have not the regular increase of elec. cond. with shorter light waves.

B. FIERTZ

**Photography of the interference figures of crystals in converging light.** P. SEVZ. *J. phys. radium* **1**, 161-77(1920).—Monochromatic light reflected from laminated glass plates as converging polarizer was allowed to pass through a thin plate of a given crystal, through a tourmaline analyzer, through an achromatic lens and finally onto an orthochromatic plate. The exterior angle between the optical axes was shown to vary with the wave length till crystals of *cerusite* and *NaNH<sub>4</sub> tartrate* become uniaxial in ultraviolet light at ordinary temps.

F. O. A.

**Researches on the optical properties of dispersed systems. II. Significance of the amicroscopic phase.** FRITZ WEIGERT AND HANS POHLE. *Kolloid-Z.* **28**, 153-61 (1921).—The color changes of photochlorides in ordinary and plane polarized light (*C. A.* **15**, 1839) were investigated ultramicroscopically with negative results. The effect is therefore due to changes in secondary amicros which spectrophotometric measurements indicate are larger than molecules. It would seem that in general with anisotropic and dichroitic systems (*i. e.*, double refracting crystals), the optical properties depend not upon relatively large visible ultramicros, but mainly upon amicroscopic molecular complexes, the *micells* of Naegeli, whose distance apart is less than a wave length of light.

JEROME ALEXANDER

**The velocity of unimolecular reactions.** ERIC K. RIDEAL. *Phil. Mag.* [6] **40**, 461-5(1920).—Referring to the anomaly reported by Lewis (*C. A.* **14**, 892) for the rate of the monomol. decompn. of  $\text{PH}_3$  according to the radiation hypothesis, R. develops an equation  $dn/dt = Ke^{h\nu/kT}$  in which  $n$  is the number of mols. changing per unit time,  $K$  is the reciprocal of the time necessary for the mol. to pass from the inactive to the active state, identical with Perrin's mol. sensibility and inversely proportional to Maxwell's "time of mol. relaxation." Values for  $K$  are calcd. for 13 metals by the thermal cond. method of Langmuir from the equation  $K = (h\sigma/3k)$ , in which  $h$  is the thermal cond. in ergs  $\text{cm}^{-1} \text{sec}^{-1}$ ,  $\sigma$  the distance between adjacent atoms, and  $k$  the gas const. =  $1.37 \times 10^{-16}$  erg. per degree. For comparison the ultra-violet frequencies  $\nu$  of the same metals are calcd. from Lindemann's m. p. equations and Hober's relation  $M\nu^2 \text{ red} = m\nu^2 \text{ violet}$ , when  $M$  and  $m$  are at. and electronic masses resp. The time of mol. relaxation  $K$  is identical with or a few times greater than  $\nu$ , the natural period of vibration. Therefore, the equation may be written  $dn/dt = \nu e^{-h\nu/kT}$ , from which the rate of decompn. according to Lewis may be calcd. as  $3.5 \times 10^{-11}$ , where the observed value is  $10.2 \times 10^{-11}$ . In the case of non-metals, where thermal cond. is mol. and not electronic in character,  $K$  is equal to the period of the infra-red vibration. For example for sulfur  $K = 1.9 \times 10^{-11}$ ,  $\nu = 2.1 \times 10^{-11}$ . On the basis of the radiation theory light would appear to be corpuscular in nature, the size of a quantum being equal to one wave-length of light. If the energy be due to an electrostatic charge  $E$ , then  $E^2 = 2hc$ , in which  $h$  is Planck's const. and  $c$  the velocity of light.

S. C. LIND

**Further investigations on the Faraday-effect in non-ferromagnetic metals.** B. POGANY. *Ann. Physik* **64**, 196-208(1921).—Continuation of work described in *C. A.* **12**, 1148. New measurements were made with thin films of Pd, Ag, Cu, Bi and Cd, be-

tween films of Fe, using light of  $\lambda$  5900 in a magnetic field of 23,400 c.g.s. units. In the case of Bi negative rotations were observed. Fe deposited on films of Pt; the sp. magnetic rotation was observed to be very low as long as the thickness of Fe film was below 10  $\mu\mu$ . With films thicker than this, however, the magnetic rotation decreased again very slowly. No explanation is suggested. Some results are also given of measurements on the magnetic rotation with light of wave lengths  $\lambda$  5000 and  $\lambda$  6500.

SAUL DUSHMAN

A quantum theory of vision. J. JOLY. *Phil. Mag.* **41**, 289-304(1921).—Starting from the exptl. fact that 1 quantum of light energy acting on a retinal nerve is sufficient to stimulate vision, J. outlines a theory of vision based on the quantum theory of photoelec. activity. He assumes that the light-sensitive substance in the eye is the rhodopsin. This substance he assumes to occur in the interior of the rods, while it bathes the exterior surface of the cones. He then assumes that the light entering the rods liberates electrons inside these, such that the max. effect of the photo-electrons is carried directly to the nerve. As several rods are connected to a single nerve ganglion the system is most efficient for responding to the very faint light stimuli which result from the elec. currents set up in the rods by the liberation of the electrons. The light falling on the rhodopsin bathing the outside surfaces of the cones liberates electrons which penetrate into the cones from the outside. The higher the frequency of the exciting light the faster are the electrons liberated and the deeper do they penetrate into the cones. The depth of penetration of the electrons into the cones and hence the velocity of the electrons liberated give the color sensation. On this basis there need only be 3 primary color sensations excited by electrons of 3 different velocities. Electrons liberated by light of wave length  $\lambda = 4500$  Å. U. are the fastest electrons, and these penetrating farthest into the cone give rise to the sensation blue; those of wave length  $\lambda$  5461 Å. U. penetrate less far, and give rise to the sensation green, while the electrons liberated by  $\lambda$  6563 Å. U. penetrate least and give the sensation red. Thus when electrons corresponding to a wave length of yellow light  $\lambda$  5893 Å. U. enter the cone the nerve will be affected in such a manner that it will respond as if it received so much red sensation of wave length  $\lambda$  6563 Å. U. and so much green light of wave length  $\lambda$  5461 Å. U. according to the proximity of  $\lambda$  5893 Å. U. to these 2 wave lengths. The combined sensations would give the color yellow. This peculiar action of the cones is facilitated by their enormously large surface exposed to the rhodopsin, and by their being associated with a single ganglion each, so that each cone excites a sep. nerve ending. Color blindness is ascribed to conditions in the nerves such that they respond but feebly to certain quanta. "Fatigue" is supposed to be due to the removal of the electrons from the particular chromogens in the rhodopsin acted upon by the light of the wave length producing the fatigue. Unless fresh rhodopsin replaces the supply about the cones temporarily exhausted of electrons in its chromogen, fatigue for the particular color follows. "After-images" are supposed to be due to the return of the electrons from the cones to the chromogens from which they were emitted. Stimulation in this case is due to the elec. displacement currents caused by the movement of the electrons from the cones.

L. B. LOEB

Atmospheric electricity. E. v. SCHWEIDLER. *Sitzb. Akad. Wiss., Wien* **128**, IIa, 947-55(1919); *Science Abstracts*, **23A**, 519-20.—A theoretical discussion is given of the number of mobile and heavy ions and of uncharged nuclei existing in a state of equil. in an ionized gas. From the theory it appears that, for small values of the ionizing power  $q$ , the simple formula  $q = \beta n$  serves to give the ion-content  $n$  with sufficient accuracy, where  $\beta$  depends to a first approximation only on the number of absorption centers present. Exptl. detns. of the value of  $\beta$  gave results from  $21.8 \times 10^{-3}$  to  $16.6 \times 10^{-3}$  sec.<sup>-1</sup> for open rooms, and a result  $42.2 \times 10^{-3}$  sec.<sup>-1</sup> for a hot room. The ion-content is consequently considerably below the value calcd. for a

given ionization strength without taking account of the absorption centers. Cf. C. A. 14, 3580. E. J. C.

**The maintenance of the earth's negative charge; a fundamental problem of atmospheric electricity.** E. SCHWEIDLER. *Ann. Physik* 63, 726-38(1920).—The author discusses in detail a previous paper on this subject by R. Seeliger, (*Ann. Physik* 62, 464(1920)). In this paper Seeliger had analyzed all existing theories as to the manner in which the earth's negative charge could be maintained. He concluded that only three of these were at all likely. Seeliger also pointed out what he considered to be a crucial expt. to distinguish between these theories. After a careful consideration of the theories the author concludes that even the 3 theories considered possible by Seeliger are unlikely with the data on hand at present. Schweidler then reclassifies the theories discussed by Seeliger in more simple fashion, and states that more than one expt. is required to det. the correct theory. He outlines an extended program of research work on problems related to the different theories. He concludes that it is only by such work that we can gain enough information about the phenomenon to be able to explain it. L. B. LOEB

**Ion-wind.** V. F. HESS. *Sitzb. Akad. Wiss., Wien* 128, IIa, 1029-79(1919); *Science Abstracts* 23A, 519; cf. C. A. 15, 336.—If the air between the 2 plates of a condenser is ionized and an elec. field applied, an air wind will normally be produced in such a direction as to move from places of weaker ionization. This phenomenon which was demonstrated qualitatively by Zeleny for X-ray ionization (1898) and studied by Ratner (1914) (cf. C. A. 8, 2117) for  $\alpha$ -ray ionization, has been explained on the assumption that the air particles become charged by the ions and move in the elec. field, thus creating what is usually termed an "ion-wind." H. exams. the effect of voltage and other controlling factors on the wind-pressure. It is shown that the decay of radioactive substances can be measured by observing the fall of wind-pressure with time. Measurements of the abs. value of wind-pressure, in dynes/cm.<sup>2</sup>, have been made in the case of a Po prepn. The "wind" pressure is proportional to the intensity of the electrostatic field. E. J. C.

Dispersion in optical glasses (WRIGHT) 19. Röntgen spectrographic investigations of iron and steel (WESTGREN) 9. Helium-bearing natural gas (ROGERS) 8. Photochemical transformations in the triphenylmethane series and photoconcentration chains (LIFSCHITZ, JOFFÉ) 10.

CUNNINGHAM, E.: *Reactivity and the Electron Theory*. 2nd Ed. Monographs on physics, edited by J. J. Thomson and F. Horton. London: Longmans, Green and Co. 148 pp. 10s. 6d.

HOLZKNECHT, G.: *Röntgenologie*. Eine Revision ihrer technischen Einrichtungen und praktischen Methoden. Part II. Vienna: Urban & Schwarzenberg. 152 pp. M. 16. For review see *Deut. med. Wochschr.* 47, 671(1921).

#### 4—ELECTROCHEMISTRY

COLIN G. FINK

**The performance of electric furnaces.** ANON. *Engineering* 111, 266(1921).—The cost of manuf. of steel in 1- to 5-ton elec. steel furnaces in England is given for comparison with the costs reported (C. A. 15, 802) for an American Greaves-Etchells furnace.

LOUIS JORDAN

**Acid vs. basic electric furnace for the foundry.** F. W. BROOKS. *Chem. Met. Eng.* 24, 794(1921); *Foundry* 49, 429-30.—The choice between an acid and a basic elec



furnace for foundry use should be made only after a careful study of all existing conditions and as many of the future conditions as possible. The acid furnace should be chosen (1) when the S and P in the scrap is and always will be less than that allowable in the castings; (2) when the range of C and Si will be narrow; (3) when close physical tests have not to be met; (4) when power consumption and rate of operation are of prime importance; (5) when very small castings are the sole output. On the other hand, basic furnaces should be installed for reasons the exact opposite of (1) to (3) above and also (4) when alloy steels are ever to be made; (5) when a steady load is essential; and (6) when refining of cast Fe is being considered. LOUIS JORDAN

**Cost of melting cold metal in electric furnace.** ANON. *Elec. Rev.* 78, 890(1921).—When cold scrap is fed into an elec. furnace there are usually considerable current-voltage fluctuations until the scrap is melted. Data from steel melting show that melting cold stock consumes up to 4/5 of the total current used, the refining period taking the other fifth. Duplexing is not only cheaper but it is also faster; but duplexing is dependent upon the running time of the cupola. C. G. F.

**The regulation of electric steel arc furnaces using movable electrodes.** W. S. MYLUS. *Trans. Am. Electrochem. Soc.* 39, preprint(1921).—A general discussion of factors having to do with the regulation of elec. furnace electrodes, the difficulties caused by the wt. and inertia of electrodes and phenomena of "hunting." A form of electrode regulator designed to operate at higher speeds, and greater precision, is described and illustrated. There are two distinct stages in the operation of this regulator, one the continuously running stage and the other the vibrating stage. The vibrating feature permits the electrode motors to operate at a high speed until the current has been brought back to 15% of normal, when the speed is gradually reduced to zero. The high electrode speed obtained makes automatic regulation on a cold charge possible, and will rapidly correct for small change in arc condition. W. F. RUBER

**Deposition of metals on wax.** SAMUEL WEIN. *Metal Ind.* 19, 71-72(1921).—A compilation of some of the methods and processes used to prepare a wax surface for deposition of metals (usually Cu). The chief application of process is in photoengraving and in the manuf. of phonographic master-records. There are 3 distinct steps. First a wax impression is made conducting, next Cu is deposited to the desired thickness, and finally this Cu shell is pried off, "and backed up" to a convenient height for handling. The usual method of making wax conducting is to cover the surface with wet or dry graphite. Next the object may be covered with  $\text{CuSO}_4$  soln. and Fe filings are added. This gives a Cu "flash" on the graphite surface which is a ready conductor of electricity. Several special formulas are given which are considered better than plain graphite for giving a conducting wax surface. CHAS. H. ELDRIDGE

**Ductile electrolytic nickel.** CHAS. P. MADSEN. *Trans. Am. Electrochem. Soc.* 39, preprint; *Chem. Met. Eng.* 24, 922-4(1921).—Domestic cold-rolled malleable Ni was used as anodes. These dissolved in the bath with an efficiency of about 97% when free from passive portions. The av. analysis of this material is as follows: Ni 95.3, Fe 2.13, Cu 0.25, Mn 0.33, C 0.30, Si 0.23. It was found that when the anode area is 1.77 times that of the cathode, the bath will remain relatively neutral for long periods of time. Any increase of anode surface over this turns the bath acid, and any decrease turns it alk., provided, however, the anode is free from passive portions. Sodium alizarinsulfonate was used as an indicator. With these anodes  $\text{Ni NH}_4$  sulfate has no advantage over Ni sulfate as an electrolyte. A little alkali metal salt, however, should be present. The addition of org. compds. diminishes the amt. of sludge and favors the production of smooth and bright metal; but such baths are exceedingly unstable and the cathode metal produced is always more brittle and cannot be carried to the same thickness as in the same electrolyte without the org. additions. The addition of a little boric acid and a little chloride is beneficial (cf. O. P. Watts, C. A.

10, 2072). Warming the electrolyte to about 55° improved the deposit. M. then discovered that if the cathode was removed periodically from the bath and exposed to the air, then reimmersed within a certain limiting time the brittleness due to H was removed; the deposit is not laminated as would be expected but decidedly ductile. With the cold-rolled anodes ductile cathode deposits were obtained by removing and reimmersing every 1 to 5 min.; with com. cast Ni anodes, 0.5 to 1 min. The c.d. was 8 amp. per sq. dm. The elec. resistivity of this new Ni is lower and the sp. gr. higher than that of any other electrolytic Ni. Its tensile strength is 50 kg. per sq. mm.; the Brinell test, 130; av. analysis, Ni 99.7, Fe 0.01, Cu nil, C 0.02. Small pits which would occasionally form even in this new ductile Ni were traced back to the anode. A new Ni anode was then developed (compn. not revealed) which gave perfect ductile, pitless cathode deposits. With this new anode the immersion frequency could be very materially reduced; in some cases, one removal and reimmersion of cathode every 2 hrs. was sufficient to produce ductile, pitless deposits 3mm. thick. C. G. F.

**The use of fluorides in solutions for nickel deposition.** WILLIAM BLUM. *Trans. Am. Electrochem. Soc.* 39, preprint(1921); *Brass World* 17, 121(1921).—In connection with a process for the electrolytic production of engraved printing plates it was necessary to obtain for the printing surface Ni coatings which would be as hard as possible, but at the same time free from brittleness or a tendency to curl or peel. If HF is added in small amts. to a Ni bath contg. boric acid, the acidity thus produced will cause an increase in anode efficiency and at least a partial neutralization of the HF, to form either  $\text{NiF}_2$  or a fluoborate. Low acidity favors good Ni deposits, but high acidity favors good anode corrosion. H electrode measurements show that normal Ni sulfate soln. has a  $p_H$  value between 6 and 7 and that satisfactory plating solns. have a  $p_H$  between 4 and 6. More satisfactory results have been obtained by measuring the H-ion concn. by means of indicators (cf. Gillespie, *C. A.* 14, 1499). The indicators which have been found most useful in measurements upon Ni solns are bromophenol blue and bromocresol purple, which together cover the range involved, i. e.,  $p_H = 3.5$  to  $p_H = 7.0$ . Methyl red is not suitable. The principal function of boric acid in Ni baths is the maintenance of a uniform low H-ion concn. This checks with findings of Hammond (*C. A.* 10, 2064). The "fluoride" soln. contained 255 g. Ni sulfate per l., 12 g. Ni carbonate, 8 g. of 50% HF and 31 g. boric acid per l. by addition. Some Ni hydroxide seps. out upon mixing. The area of the Ni anode was about the same as that of the Ni or steel cathode. Compn. of Ni anode: Ni (+ Co), 97.5%, C 1.5, Si 0.05, Cu 0.20, Fe 0.60. With a c.d. of 1 amp. per sq. dm. the tensile strength of a 0.75 mm. thick deposit was 7,000 kg. per sq. cm; with a c.d. of 5, it was 9,350 kg. These values are decidedly higher than for corresponding deposits from chloride-sulfate baths. Furthermore the fluoride bath produces little or no sludge. The crystal structure of the cathode is finer. The fluoride soln. corrodes the hot rolled anodes about as readily as the cast anodes but it corrodes electrolytic Ni anodes very poorly. The rolled Ni anodes analyzed: Ni 98.5, Fe 0.64, Cu 0.17, C 0.05, Mn 0.35. The cathode efficiency for c.d.s. up to 2 amp. per sq. dm. is above 99%. Higher c.d. can be used in the fluoride bath without producing cracking or curling of the deposit. The F content of the bath can be detd. approx. by titration with  $\text{FeCl}_3$ . Also in *Chem. Met. Eng.* 24, 1109-15(1921). C. G. F.

**Recent work on nickel plating.** W. E. HUGHES. *Electrician* 86, 583-4(1921).—A review of the work of Madsen and of Blum. See 2 preceding abstracts. C. G. F.

**Recent developments in the electrolytic production of hydrogen and oxygen.** A. J. HALS. *J. Soc. Chem. Ind.* 40, 122-4R(1921).—The cells on the market today, many of which have been designed since 1913, may be classified as bell, filter press, and unit type. Diaphragm unit cells, sometimes known as tank cells, have recently been much improved and are the most perfect contrivances for producing O and H by electrolysis.

Seven cells are compared as to voltage required, vol. H per kw. hr., and purity of H and O. Cost and layout of plant are briefly discussed. D. MacRAE

The electrolytic manufacture of *p*-aminophenol. A. S. McDANIEL, L. SCHNEIDER AND A. BALLARD. *Trans. Am. Electrochem. Soc.* 39, preprint(1921).—Nitrobenzene in  $H_2SO_4$  soln. was electrolytically reduced to  $PhNH_2$  and this changed over to  $p-HOC_6H_4NH_2 \cdot H_2SO_4$ . Preliminary expts. showed that Pt electrodes were the best and that the electrolyte must be kept free from contamination with Fe and other heavy metals, that ice-cooling was necessary for high yields of  $p-HOC_6H_4NH_2 \cdot H_2SO_4$  with minimum sulfonate, and that the best cathode c.d. is 6 to 8 amp. per sq. dm. with the anode density approx. double that of the cathode. All attempts to produce  $p-HOC_6H_4NH_2$  without using a porous diaphragm failed; a thin but very dense porous porcelain diaphragm gave best results. Pb anodes gave too much sulfonic acid. The crude nitrobenzene was treated with  $Na_2CO_3$  to neutralize all acid present, and then distd. The catholyte consisted of 540 cc. nitrobenzene plus 1800 cc. of 19%  $H_2SO_4$ ; the anolyte,  $H_2SO_4$  of sp. gr. 1.75. The voltage per cell, about 8, of which about 4 v. was due to the diaphragm. Temp.,  $30^\circ$ . The sludge of sulfate and sulfonate produced was removed, partially dried, covered with concd. HCl and then centrifuged. The crude hydrochloride was put through a chemical process of purification (see original) and pure cryst. hydrochloride obtained. The chem. yield was about 40% to 50% of the theoretical; the current yield was about 25%; about 22 g. per kw. hr. The relatively high cost of production was due to the  $H_2SO_4$ , as no recovery of the used acid had been made. C. G. F.

A contribution to the history of the metal filament lamp (osmium-filament). C. AUER VON WELSBACH. *Elektrotech. Z.* 42, 453-4(1921).—A short review. The author touches upon the failure of the oxide filament and the development of the epoch-making osmium filament lamp, a forerunner of the Ta and W filament lamps. C. G. F.

Synthetic insulation materials. R. W. KENNEDY. *Elec. Rev.* 87, 836(1921).—A short general discussion. C. G. F.

Standard tests for electrical insulation materials. (Provisional draft.) P. SCHIRP for the Verband deutscher Elektrotechniker. *Elektrotech. Z.* 42, 500-2(1921).—Illus. description of tests to det. hardness, ductility, softening point, elec. properties, etc. C. G. F.

Behavior of a three-electrode vacuum tube as an oscillation generator. EIJIRO TAKAGISHI. *Electrician* 86, 346, 374(1921).—The oscillating phenomena of the tube, are dealt with from "dynamic or derived characteristics" which differ greatly from "static characteristics." It has been found that these characteristics can be derived solely from the circuit conditions, and thereby the oscillating conditions of the system can be explained fully enough for practical application, if not with absolute accuracy. The effect of reactance, capacity and condenser across the inductance are discussed in detail and some exptl. results are given. W. E. RUDER

Cobalt (ANON.) 9. Electrolytic reactions of naphthalene and its derivatives (ONO) 10.

Storage batteries. C. A. ALLISON. *Brit.* 160,317, Jan. 8, 1920. Storage batteries are filled with a mixt. of 70% of powdered pumice stone and 30% of asbestos, or nitrated cotton. The pumice stone is first crushed and washed and then boiled in  $H_2SO_4$ . It is then powdered and ignited and again treated with  $H_2SO_4$  and finally dried.

Extracting molybdenum; calcium molybdate. AMPERE-GES., F. ROTH, AND O. DIEFENTHAUER. *Brit.* 160,143, March 12, 1921. Briquets of Ca molybdate for subsequent reduction in an elec. furnace in admixt. with coal and other materials, are prepd. by mixing roasted molybdenite, powdered limestone and  $H_2O$ , and drying.

**Metallic plates or sheets by electrodeposition.** S. O. COWPER-COLLS. *Brit.* 160,554, Dec. 22, 1919. In making metal plates or sheets, such as Cu or Zn plates for printing, a cathode, which may be of polished brass, Cu, or gun-metal coated with Ag or Ni, is provided with a non-adherent surface by forming a sulfide or oxide, or by applying a medium such as beeswax dissolved in turpentine. A suitable construction is specified.

## 5—PHOTOGRAPHY

LOUIS DERR

**History of persulfate reduction.** G. I. HIGSON. *Phot. J.* 61, 237-44(1921).—A discussion of the various theories of the action of the salt is followed by an extended bibliography.

L. DERR

**Silver oxalate in the copper intensification process.** R. NAMIAS. *Il prog. fot.* 1915, 48; through *Eastman Kodak Abstr. Bull.*—In this method, which consists of bleaching the image in CuBr<sub>2</sub> and darkening by AgNO<sub>3</sub>, Ag oxalate is recommended instead of nitrate; the action is rapid and the images are free from spots and other irregularities.

L. DERR

**Fading of blue prints.** EASTMAN KODAK RESEARCH LAB. REPORT No. 1091.—Rapid fading of ordinary blue prints is usually caused by insufficient washing or by the H<sub>2</sub>O<sub>2</sub> sometimes added to accelerate development. The image is rendered much more stable and contrasty by developing in 0.2% K<sub>3</sub>Fe(CN)<sub>6</sub> and washing 4-5 min. A faded image can usually be restored by keeping in the dark in a damp atmosphere.

L. DERR

**Sensitometer with non-intermittent exposure.** A. B. HITCHINS. *Anso Research Lab. Bull. soc. franc. phot.* 8, 74-7(1921).—A metal slide on horizontal rollers is drawn uniformly over the plate or film to be tested, by an electric motor of controlled speed. In the middle of the slide there is a slot, narrow at one end and wide at the other, so as to give to different portions of the plate exposures in geometrical progression.

L. DERR

**Light-sensitiveness of collodion.** B. HOMOLKA. *Phot. Korr.* 57, 239-41(1920).—With 9-aminophenanthrene as an indicator, it can be shown that HNO<sub>2</sub> is liberated from cellulose nitrate by the action of light. A sheet of baryta-coated paper, flowed with collodion contg. 9-aminophenanthrene and exposed 60-90 min. under a negative, gives a red positive image in 9,9'-azoxyphenanthrene, which can be fixed with benzene.

L. DERR

**Instrument for measuring glaze and blackening of photographic papers.** K. KJESER. *Phot. Korr.* 57, 287-9(1920).—A modification of the Martens polarization photometer measures the light reflected from the paper.

L. DERR

**Two-color kinematograph films by chemical toning.** ANON. *Brit. J. Phot.* 67, suppl. 37-8.—The prints are made in accurate register on opposite sides of a film coated on both sides. One of the images is from a negative recording the reds of the subject, the other from the corresponding negative recording the green-blue. After developing and fixing, the entire positive film is immersed in a toning bath, preferably red-toning, for example, one contg. U salts; the second toning bath, which may contain ferric salts, is applied only to the one appropriate face of the film, and converts the image into a blue-green compd. The two colored images, in register with each other, will then give by projection the natural colors, approximately, of the object photographed.

L. DERR

**Further development of Ives' mordant dye-image process.** F. E. IVES. *Brit. J. Phot.* 67, suppl. 43.—The special fixing bath now recommended is: water 30, CuSO<sub>4</sub> 1, hypo 2.5, 30% CH<sub>3</sub>COOH 1.

L. DERR

**A new green sensitizer.** E. KÖNIG. *Brit. J. Phot.* 68, suppl. 16(1921).—Pina-

flavol (Hoechst) belongs to a new class of basic dyes, yellow in color and sensitizing for the green region of the spectrum. Pinaflavol yields an even sensitiveness band over the violet, blue, and green, falling sharply to the D-line in the yellow. For 3-color work a yellow filter may therefore be used to obtain the red-printing negative, with decided reduction of exposure time. This dye cannot be combined with other sensitizers.

L. DERR

**Photography.** W. GRIESE-GREEN, J. N. THOMSON and COLOR PHOTOGRAPHY, LTD. Brit. 160,540, Dec. 20, 1929. Toning solns. are described, more particularly for obtaining one element of a two- or three-color photography, which give a range of colors extending from yellows to deep reds. The ingredients are  $K_4Fe(CN)_6$ , U nitrate, rose bengale naphthol yellow, HOAc, and iodine. In addition to or in substitution for the iodine, an isocyanine dye such as pinacyanol or sensitol red may be used. In prep. the soln., the  $K_4Fe(CN)_6$ , uranium nitrate, HOAc, and iodine (if used) are dissolved in  $H_2O$  and this soln. is added to a soln. of the other ingredients in alc. A fixing bath of  $\frac{1}{4}$  oz. hypo and 60 gr. of metabisulfite in 20 oz. of  $H_2O$  is used.

**Photography.** J. H. CHRISTENSEN. Brit. 160,739, July 30, 1920. In producing prints or photographs a phosphorescent screen or sheet is placed in contact with the print or photograph and illuminated or acted upon by colored light. The sheet is subsequently placed in contact with a sensitive film to produce an image of the print or photograph. The translucent phosphorescent sheet may be colored or the phosphorescent medium itself may be colored. In prep. a translucent sheet the phosphorescent material is comminuted by mixing it with liquid and shaking it up with glass balls. The comminuted mixt. is mixed with gelatin and glycerol and poured on to a glass plate covered with a film of rubber. After the phosphorescent material has settled and the film solidified a colored collodion coating is applied, dried, and then stripped and the phosphorescent surface exposed to strong light to render the material active.

**Photography.** W. VAN D. KELLEY. Brit. 160,137, March 11, 1921. In a process for obtaining color transparencies by bleaching the Ag image and subsequently dyeing it, the Ag image is bleached in a bath that will transform that Ag into a compd. which is not redevelopable by a reducing agent or developer, and then dyed in an acid or azo dye bath, which is mordanted only at the places *in situ* with the original Ag. The Ag image is first hardened by a formalin bath. The bleaching bath contains a Cu or Cr salt or both. A bath instanced contains  $K_2Cr_2O_7$ , KBr,  $CuSO_4$ , and HCl or HOAc. The image may then be treated in an acid fixing bath of hypo and Na metabisulfite, or this may be done after dyeing. The dyes used are acid or azo dyes and ponceaus, fast reds, acid fuchsin; dyes such as used in wool dyeing give a choice of pure non-dichroic colors and a very transparent image. To brighten the color a bath of  $\frac{1}{4}\%$  soln. of  $H_2SO_4$  may be used. The process is used to obtain one more of the component color elements in a two or three-color photograph or kinematograph film. The components may be on sep. films, or in sep. coatings on one film, either on the same or on opposite sides.

## 6—INORGANIC CHEMISTRY

H. I. SCHLESINGER

**Nature of subsidiary valence. XXV. Stability of complex cations associated with anions of varying size.** FRITZ EPHRAIM AND FRANZ MÜLLER. Univ. Berne. Ber. 54B, 973-8(1921); cf. C. A. 14, 2309.—The significance of the "space-filling" of the single mol. portions of a salt for the stability of the whole neutral mol. is again taken up. The prepn. and properties of the following compds. are described:  $[Ni(NH_3)_6]MoO_4$ ,  $[Ni(NH_3)_6]WO_4$ ,  $[Ni(NH_3)_6]CrO_4$ ,  $[Ni(NH_3)_6]SO_4$ ,  $[Ni(NH_3)_6]SeO_4$ . It is

shown that the dissociation temp. of these compds. increases proportionally with the mol. vol. of the anion:

X.	MoO <sub>4</sub>	WO <sub>4</sub>	CrO <sub>4</sub>	SO <sub>4</sub>	SeO <sub>4</sub>
Dissociation temp.					
of Ni(NH <sub>4</sub> ) <sub>2</sub> X =	116°	120°	135°	146°	168°
Mol. vol. of X =	32.8	33.9	36.5	41.8	?

H. JERMAIN CR EIGHTON

**Reduction by means of silicon.** LOUIS KAHLENBERG and WM. J. TRAUTMAN. *Trans. Am. Electrochem. Soc.* 39, preprint(1921).—Very finely powdered commercial cryst. Si, containing 95% Si and 5% Fe, was used to reduce a large number of metallic oxides, chromates, tungstates and molybdates. Three methods for effecting the reduction were employed: (1) The finely pulverized compd. was mixed with the powdered S and heated in a test-tube in a Bunsen flame. (2) The mixt. was placed in a Hessian crucible and the reaction started by means of an ignition cherry. (3) The reaction was induced by treating the mixt. in a Hessian crucible with an elec. arc formed between two electrodes of Si. This method 3 is a new and general one which has proved to be very efficient. A series of 92 preliminary expts. was performed in which the three methods were employed. A few reactions were selected from these for further study. With the exception of Pb<sub>2</sub>O (which did not react with Si at all) the oxides of Pb were readily reduced by means of Si, metallic Pb and a slag of Pb silicate being formed. No silicide of Pb could be detected (cf. Warren, *Chem. News* 64, 75(1891)). BaCrO<sub>4</sub>, CaCrO<sub>4</sub>, PbCrO<sub>4</sub>, and Na<sub>2</sub>CrO<sub>4</sub> were all reduced, the silicide CrSi<sub>2</sub> and a slag of silicates of the respective metals being formed, except in the case of Pb where no silicide was obtained. BaMoO<sub>4</sub> and PbMoO<sub>4</sub> reacted only partially; no free metal nor silicide was obtained. The tungstates of Ba, Pb and Na behaved similarly. Cr<sub>2</sub>O<sub>3</sub> was reduced to Cr<sub>2</sub>Si<sub>3</sub> (isolated for the first time; cf. Frilley, *C. A.* 6, 1097). WO<sub>3</sub> and MoO<sub>3</sub> were only partially reduced. Sb<sub>2</sub>O<sub>3</sub> and Bi<sub>2</sub>O<sub>3</sub> were reduced to metal. SnO was readily reduced, Sn and SiO<sub>2</sub> being formed.

C. G. F.

**Tellurium nitrite.** FELIX VON OEFFLE. *Pharm. Zentralhalle* 61, 491-2(1920).—Tellurium nitrite which is obtained by the action of HNO<sub>3</sub> on Te when large quantities of material and a vessel at least 50 cc. high are used, is a flesh-colored ppt. which can be dried at 100° without decomn. TeO<sub>2</sub> is obtained by heating to a higher temp.

H. A. SHONLE

**Complex metallic amines.** V. *cis*-Succinatodiethylenediaminecobaltic salts and other cobaltamine salts containing a seven-membered ring in the complex. JAMES COOPER DUFF. Birmingham, Eng. *J. Chem. Soc.* 119, 385-90(1921); cf. *C. A.* 14, 3024.—Werner was unable to obtain cryst. salts by the use of succinic, malic and tartaric acids. Duff shows that succinic anhydride reacts to form cryst. products, as do mesotartaric, maleic, dibromosuccinic, itaconic and citraconic acids, in which the CO<sub>2</sub>H groups are in the *cis*-position, while tartaric, malic and mesaconic acids produce viscous sirups which could not be made to solidify. The results prove that only when the CO<sub>2</sub>H groups are in the *cis*-position can a 7-membered ring be obtained in the complex. *cis*-Succinatodiethylenediaminecobaltic salts, YX (where Y is (-CH<sub>2</sub>-CO<sub>2</sub>H)(Coen<sub>2</sub>)). *Bromide*, YBr·2H<sub>2</sub>O (C<sub>12</sub>H<sub>20</sub>O<sub>4</sub>N<sub>4</sub>BrCo<sub>2</sub>·2H<sub>2</sub>O), minute brownish red plates from 1.6 g. (CH<sub>3</sub>CO<sub>2</sub>)<sub>2</sub>O and a boiling soln. of 5 g. carbonatodiethylenediaminecobaltic bromide (A) in 100 cc. H<sub>2</sub>O. *Nitrate*, C<sub>12</sub>H<sub>20</sub>O<sub>4</sub>N<sub>4</sub>Co<sub>2</sub>·2H<sub>2</sub>O, microscopic brownish red elongated plates by pptg. 3 g. of the bromide with 1.24 g. AgNO<sub>3</sub>. *Hydrogen succinate*, C<sub>12</sub>H<sub>20</sub>O<sub>4</sub>N<sub>4</sub>Co<sub>2</sub>·4H<sub>2</sub>O, by adding 4.44 g. of the acid to a boiling soln. of the base from 6 g. of the bromide and 4 g. Ag<sub>2</sub>O, brownish red elongated plates. *cis*-Maleatodiethylenediaminecobaltic salts. *Bromide*, C<sub>12</sub>H<sub>16</sub>O<sub>4</sub>N<sub>4</sub>BrCo<sub>2</sub>·2H<sub>2</sub>O, minute brownish red crystals. The aq. soln. does not give a ppt. with Ba(OH)<sub>2</sub>. *Nitrate*, C<sub>12</sub>H<sub>16</sub>O<sub>4</sub>N<sub>4</sub>Co<sub>2</sub>·H<sub>2</sub>O, minute brownish red crystals. *Hydrogen maleate*, C<sub>12</sub>H<sub>16</sub>O<sub>4</sub>N<sub>4</sub>Co<sub>2</sub>, minute pink.

flattened needles; the aq. soln. gives a ppt. with  $\text{Ba}(\text{OH})_2$ , indicating that the salt is a maleate. *cis-Mesotartratodithylenediaminecobaltic salts*. *Bromide*,  $\text{C}_8\text{H}_{10}\text{O}_6\text{N}_4\text{BrCo} \cdot 2\text{H}_2\text{O}$ , minute, brownish red crystals. *Hydrogen mesotartrate*,  $\text{C}_{12}\text{H}_{18}\text{O}_{12}\text{N}_4\text{Co} \cdot \text{H}_2\text{O}$ , minute pink crystals. *cis-Dibromosuccinatodithylenediaminecobaltic salts*. *Bromide*,  $\text{C}_8\text{H}_{10}\text{O}_6\text{N}_4\text{Br}_2\text{Co} \cdot 2\text{H}_2\text{O}$ , minute purplish red crystals by stirring 4.32 g. of the Br acid into a boiling soln. of 5 g. A in 120 cc.  $\text{H}_2\text{O}$ . *Nitrate*,  $\text{C}_8\text{H}_{10}\text{O}_6\text{N}_4\text{Br}_2\text{Co}$ , purplish pink minute crystals. *Normal dibromosuccinate*,  $\text{C}_{20}\text{H}_{30}\text{O}_{12}\text{N}_4\text{Br}_2\text{Co}_2$ , pale mauve minute crystals. *cis-Itaconatodithylenediaminecobaltic hydrogen itaconate*,  $\text{C}_{14}\text{H}_{18}\text{O}_8\text{N}_4\text{Co} \cdot 5\text{H}_2\text{O}$ , brownish red flattened needles. *cis-Citraconatodithylenediamine hydrogen citraconate*,  $\text{C}_{14}\text{H}_{18}\text{O}_8\text{N}_4\text{Co}$ , minute pink needles. The use of fumaric acid gave a clear red jelly in every case, which yielded a pink, amorphous powder when stirred with alc. The analyses and reactions correspond to the expected salts but the substances were apparently of a more complex nature. The bromides gave pink amorphous ppts. with  $\text{HgBr}_2$  in KBr soln.  $\text{H}_2\text{PtCl}_6$  gave pink ppts. C. J. WHEAT

## 7—ANALYTICAL CHEMISTRY

WILLIAM T. HALL

**A new reagent for wood and vanillin.** J. GRÜSS. *Ber. botan. Ges.* **38**, 361-8 (1921).—Vanadic acid, especially in the presence of excess  $\text{H}_3\text{PO}_4$ , gives, with lignin, a distinct and characteristic yellow brown color with a touch of red. The color is removed by treating with  $\text{NH}_3$ , and intensified by chromic acid. Vanillin gives a red brown ppt. with the vanadic acid- $\text{H}_3\text{PO}_4$  mixt. A lignin compd. was prepd. from wood by heating with alc. HCl. Its analysis corresponded to the formula  $\text{C}_{28}\text{H}_{44}\text{O}_{16}$ . T. G. PHILLIPS

**The use of sodium persulfate in analysis.** L. DÉBOURDEAUX. *Bull. sci. pharmacol.* **28**, 191-202 (1921); cf. *C. A.* **15**, 2047.—The use of  $\text{Na}_2\text{S}_2\text{O}_8$  is advocated for the detn. of C in compds. which yield  $\text{CO}_2$  when treated by the reagent in acid soln., such as acetic or oxalic acid; in compds. which are completely oxidized in alk. soln. of the persulfate, e. g., cacodylic acid; in compds. sol. in  $\text{H}_2\text{O}$  and acids but which on combustion yield incomplete oxidation products, e. g., lactic acid; in compds. which yield insol. products, e. g., acetylsalicylic acid; and in compds. insol. in acid but sol. in alk. soln., e. g., terpin, camphoric acid, etc. A long list of satisfactory results is given.

F. S. HAMMETT

**Preparation of red litmus paper.** W. FRESSENIUS AND L. GRÜNHUT. *Z. anal. Chem.* **59**, 233-4 (1920).—Boil 100 g. of powdered litmus for 15 mins. with 500 cc. of 94% alc., filter the mixt., dry the insol. portion at  $100^\circ$ , and then grind it with 500 cc. of cold water; stir this mixt. occasionally during 24 hrs., filter, and set aside a portion of the filtrate; treat the main portion with dil.  $\text{H}_2\text{SO}_4$  (sp. gr. 1.11) until the color changes to red. Boil the soln. for 15 mins., replacing the evapd. water, and, if the color changes to blue, add a trace more acid. Then dip a strip of paper in the soln. and dry. If too much acid has been used, add a quantity of the reserved portion of the filtrate. When the desired tint after drying has been obtained, dip strips of paper in the soln. and dry in an atm. free from acids and  $\text{NH}_3$ . Litmus paper thus prepd. should give a blue coloration when treated with a drop of a mixt. of 50 cc. of boiling water and 1 drop of 0.25 N alkali soln. J. S. C. I.

**Evaluation of lime by causticizing tests.** CARL MOE. *Paper Industry* **3**, 109-10 (1921).—A discussion of the method proposed by Griffin in which a weighed quantity of the lime to be tested is boiled for 1 hr. with a weighed quantity of dry soda ash in some excess of the equiv. to the quantity of lime taken. After settling, the ratio of  $\text{Na}_2\text{CO}_3$  and NaOH is detd. in the clear liquor by titrating with standardized acid, using phenolphthalein and methyl orange as indicators. H. H. HARRISON

**New method for the estimation of acetoacetic ester.** H. YANAGISAWA AND M. KAMIO. *J. Pharm. Soc. Japan* No. 469, 240-6(1921).—It was found by expt. that 3 mols. of the ester react with  $\text{Na}_2\text{SO}_3$  liberating 2 mols. of  $\text{NaOH}$  which can be titrated with standard acid using phenolphthalein as indicator. Dissolve about 10 g. of the ester in dil. alc. and make up to 100 cc. Take 5 cc. of this soln. and treat it with exactly 50 cc. of 25 g. recrystallized  $\text{Na}_2\text{SO}_3$  dissolved in 100 cc. of water, and titrate with  $N$   $\text{H}_2\text{SO}_4$ . Det. separately the free acid present by dilg. 5 cc. with 20 cc. of water and titrating with standard alkali and also the vol. of standard  $\text{H}_2\text{SO}_4$  required to give an acid reaction with 50 cc. of the sulfite soln., and make suitable corrections from the result of the first titration. The method is useless if any other aldehyde or ketone is present. S. T.

**A simple method for the determination of sulfur dioxide and sulfur trioxide in the sulfur burner gases.** R. DIECKMANN. *Papierfabr.* 19, 285-7(1921).—The method consists in using an Orsat apparatus with a double indicator—phenolphthalein and methyl orange; upon passing the mixed gases, the first color change, red to yellow, gives the vol. % of  $\text{SO}_2$  and  $\text{SO}_3$ ; the gas is then passed until the  $\text{NaOH}$  is neutd., the difference of the two readings giving the  $\text{SO}_2$ . From this the  $\text{SO}_3$  is calculated.

C. J. WERT

**Analysis of leucites and leucitic minerals.** G. TOMMASI. *Ann. stat. chim.-agrar. sper.* 11, 9, 95-106(1917-19).—1.25 g. of the leucite or leucitic mineral, ground to an impalpable powder, is treated in a covered beaker with about 45 cc. of  $\text{HCl}$  and 5 cc. of  $\text{HNO}_3$ , first for 2 hrs. on a water-bath and then for 20 mins. on a sand-bath. The insol. silicious matter is then estd. in the ordinary way, the alkalis are isolated as usual, and the K is estd. by the perchlorate method. This procedure gives results agreeing with those obtained when the mineral is attacked by  $\text{HF}$  or by  $\text{NH}_4\text{Cl}$  and  $\text{CaCO}_3$  according to the J. Lawrence Smith method. J. S. C. I.

**Rapid method for disintegrating metallurgical products which are insoluble in mineral acids.** IGNAZIO COMPAGNO. *Giorn. chim. ind. applicata* 2, 554-5(1920).—Fe alloys and other metallurgical products may be prepared for soln. by heating the powdered substance with a mixt. of 52 pts.  $\text{Na}_2\text{CO}_3$ , 20 pts.  $\text{KNO}_3$  and 28 pts. Mg powder. Place about 4 g. of the mixt. on the bottom of an Fe or Ni crucible, add 0.5 g. of the finely-powdered sample mixed with 2 g. of the mixt. and cover with about 5 g. more. Place the crucible on a small, raised triangle in a porcelain dish. Place a strip of Mg ribbon in the middle of the reaction mixt., light the ribbon and at once cover with a porcelain dish slightly smaller than that holding the crucible. In some cases it is advisable to heat the crucible over the blast lamp as soon as the first violent action is over. The product of the ignition is decomposable by mineral acids. R. S. P.

**Determination of small quantities of lead (in ores, etc.).** J. H. HASTINGS. *Eng. Mining J.* 110, 867-8(1920).—In the titration of small quantities of Pb sulfate in  $\text{AcONH}$ , soln., with  $(\text{NH}_4)_2\text{MoO}_4$  soln., using tannin soln. as indicator (Alexander, *Eng. Mining J.* 1893, 298), the end-point is indefinite owing to the slowness of the reaction between the molybdate and the Pb. This may be overcome by adding a definite amt. of standard Pb soln. to the test soln. before the Pb is titrated, allowance being made subsequently for the amt. of added Pb. J. S. C. I.

**Determination of titanium and iron in rocks.** FABIO FERRERI. *Giorn. chim. ind. applicata* 2, 497-8(1920).—The Ti is reduced in  $\text{HCl}$  soln. by careful treatment with Zn with exclusion of air, and the resulting trivalent Ti is titrated with methylene blue soln. The iron is oxidized to the tervalent state and titrated with standard  $\text{TiCl}_3$  soln., using  $\text{KCNS}$  as indicator toward the last. ROBERT S. POSMONTIER

**Determination of arsenic and phosphorus in common alloys.** IGNAZIO COMPAGNO. *Giorn. chim. ind. applicata* 2, 493-7(1920).—*Detn. of As.* Dissolve 5 g. of the material



in 70 cc. of 7.5 *N* HNO<sub>3</sub>, add 10 cc. concd. H<sub>2</sub>SO<sub>4</sub>, evap. carefully to dryness, taking care not to decompose sulfates of Fe, etc., break up the mass to a powder and again heat to remove any free H<sub>2</sub>SO<sub>4</sub>. Dissolve the residue in hot, concd. HCl and transfer to a 500 cc. distg. flask using 200 cc. of acid in the flask. Attach the flask to a condenser, add 5 g. of pure Cu and distil slowly until about 135 cc. of distillate have been collected in ice-cold water. Ppt. the As by H<sub>2</sub>S, remove the excess of the latter with CO<sub>2</sub> and weigh the As<sub>2</sub>S<sub>3</sub> on a tared Gooch crucible, after washing with water, alc., and CS<sub>2</sub>. *Detn. of P.*—Use the solu. remaining in the distg. flask. After the removal of SiO<sub>2</sub>, evap. several times with HNO<sub>3</sub> and then ppt. as phosphomolybdate in the usual manner after decomposing any carbonaceous matter with permanganate and removing the excess of the latter with oxalic acid.

ROBERT S. POSMONTIER

**Determining moisture content of wood.** FOREST PRODUCTS LAB. *Paper Trade J.* 72, No. 18, 19(1921).—A specified wt. of wood chips is immersed in kerosene in a retort and heated. The water in the chips changes to steam at 100° and goes through a water-jacketed condenser tube and is caught in a graduate. The b. p. of kerosene being higher than water, all the moisture will be driven off the chips before the oil vaporizes. The water in the graduate is allowed to settle and a direct reading is taken. The variation of this method from wt. detns. is less than 1% and the time required is about 10 mins.

H. H. HARRISON

Absorption of iodine by starch (EULER, MYRBÄCK) 28.

GRIFFIN, R. C.: **Technical Methods of Analysis.** New York: McGraw-Hill Book Co. 666 pp.

## 8—MINERALOGICAL AND GEOLOGICAL CHEMISTRY

EDGAR T. WHERRY AND WALTER F. HUNT

**The formation of liquid carbon dioxide inclusions in minerals.** RUDOLF SCHARIZER. *Graz. Centr. Mineral. Geol.* 1920, 143-8.—Liquid inclusions of CO<sub>2</sub> with a bubble of more than 50% vol. are formed above, with less than 50% below, the critical temp. Others contain no liquid.

W. F. FOSHAG

**The portions of the Bitburg iron in Germany.** R. BRAUNS. *Bonn. Centr. Mineral. Geol.* 1920, 1-9.—A description of the portions of the Bitburg meteorite, found in 1802, that remain in Germany. It is an Fe meteorite with small amts. of olivine, but variable in character.

W. F. FOSHAG

**The origin of the colemanite deposits of California.** WILLIAM F. FOSHAG. *Econ. Geol.* 16, 199-214(1921).—F. assumes a volcanic origin of the B of the California borate deposits. This has been concd. as ulexite and borax in the closed basins of the playa lakes. These deposits were subsequently covered and uplifted, and then subjected to leaching by ground water. Colemanite is then formed from the ulexite by the reaction:  $2\text{NaCaB}_3\text{O}_7 \cdot 8\text{H}_2\text{O} = \text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O} + \text{Ca}_2\text{B}_6\text{O}_{11} \cdot 5\text{H}_2\text{O} + \text{H}_2\text{O}$ , which has been verified experimentally by Van't Hoff.

C. B. SLAWSON

**The origin of graphite.** THOMAS H. CLARK. *Econ. Geol.* 16, 167-83(1921).—Graphite deposits fall into 2 classes, (1) bedded and disseminated deposits derived by metamorphic action from the carbonaceous organic matter in sediments; and (2) vein deposits formed by igneous intrusions which constitute the greater part of our com. deposits. In these vein deposits the magmas have absorbed CaO from the limestones, freeing CO<sub>2</sub>, which is then reduced by free H or other reducing agents in the magma.

CHESTER B. SLAWSON

**The graphite rocks of Sleaford Bay, South Australia.** C. E. TILLEY. *Econ. Geol.* 16,

184-98(1921).—These rocks consist of graphitic biotite schists and gneisses which are interbedded with crystalline dolomites, Ca-Mg silicate rocks, and garnet gneisses. These rocks were originally bituminous shales, arkoses, and sandstones which have been subjected to intense metamorphism. An inorg. origin is assigned to graphite veins in the dolomites and Ca silicate rocks. Although the reversibility of the 2 reactions  $C + H_2O = CO + H_2$ ;  $CO + H_2O = CO_2 + H_2$  has never been verified experimentally it is theoretically assumed that under high pressures and temp. it would take place, because of the endothermal character of the reactions. C. B. SLAWSON

**The coal basin of Sarre and Lorraine.** ROBERT COURAU. *Bull. soc. ind. Mulhouse* 86, 414-30(1920).—C. reports on a geologic and economic survey of the coal deposits of the locality.

L. W. RIGGS

**Helium-bearing natural gas.** G. SHERBURNE ROGERS. U. S. Geol. Survey. *Professional Paper No. 121*, 110 pp.(1921).—The general chemistry of He and its relations to radioactive substances are discussed. While He is widely distributed it occurs in concns. above 0.5% in but few localities, the most notable being the Kansas-Oklahoma and the Texas fields. In these, gas richest in He is at comparatively shallow depths in the upper and middle Pennsylvanian strata. In Ohio, gas with 0.33% He was found in Silurian strata. Analyses of 24 He-bearing natural gases are given and although over 40% of N may be associated with less than 0.5% He, no sample gave 0.5% He which did not contain at least 25% N. Methods of analysis are given in detail by C. W. Seibel. The He content of minerals, rocks, mine gases, mineral springs, volcanic and fumarole gases and the atm. is described, with many analyses. It is estd. that between 8 and 30 million cu. m. of He are generated annually by radioactive processes. Theories of the origin of He in natural gas are presented and data given for over 300 samples of natural gas tested for He.

L. W. RIGGS

**Classification of eruptive rocks.** PAUL NIGGLI. Tübingen. *Centr. Mineral. Geol.* 1920, 161-75.—Eruptive rocks fall into 3 divisions: Ca-alk. series (gabbro-diorite or Pacific Province), Na series (foyaite-theralite or Atlantic Province), K series (syenite-shonkinite or Mediterranean Province). In the Ca-alk. series increasing  $SiO_2$  content leads to hornblende or augite with Ca plagioclases (gabbro, norite), the Na in the plagioclases then increases, biotite appears (diorite), then Na plagioclases, orthoclase and quartz (quartz-diorite, granite). In the Na series increasing  $SiO_2$  gives first plagioclase, then nepheline, lepidomelane, alk.-augite, etc.; this includes shonkinite, monzonite, and syenite. The K series is intermediate between the other 2; it includes theralite, essexite, foyaite and alkali granite.

W. F. FOSHAG

**An alkali gneiss from the Pre-Cambrian of New Jersey.** NORMAN E. A. HINDS. *Am. J. Sci.* [5] 1, 355-64(1921).—The rock studied was collected from a tunnel cut through Van Nest Gap, near Oxford Furnace, N. J. The geology and petrography of the region are described. Analysis by J. E. Wolff of this rock gave  $SiO_2$  61.18,  $Al_2O_3$  16.86,  $Fe_2O_3$  1.95, FeO 4.74, MgO 0.60, CaO 2.91,  $Na_2O$  5.33,  $K_2O$  4.12,  $H_2O$  + 0.85,  $H_2O$  - 0.04,  $TiO_2$  0.61, MnO 0.06,  $P_2O_5$  0.15,  $ZrO_2$  0.16, sum 99.56%. Analyses of 1 Madagascar, and 1 New York and 5 European rocks are quoted for comparison. This rock is classified as an alkaline quartz syenite gneiss belonging to the subrang akerose in the norm classification, and to the family granodiorite, in the quant. mineralogical classification of Johannsen. While the exact geological relations of this rock are unknown, its chem. compn. places it with the dark colored variety of the Byram member of the N. J. Pre-Cambrian gneisses. It is considered to be an igneous rock in which foliation developed in the magma during the process of crystn. This type of foliates is rare.

L. W. RIGGS

**Geology and ore deposits of the Walhalla-Wood's Point auriferous belt.** N. R. JUNNER. *Proc. Australasian Inst. Mining and Met.* Sept. 30, 1920, 127-258.—The physiography, general geology and petrology are described in 53 pages; metasomatism

and genesis of the Au in 36; and the secondary enrichment in the mines in 27. A general summary fills 5 pages and 24 microphotographs are shown. Specimens, of which analyses are reported in the following table, represent (1) Porphyritic basalt, Coronation mine, Tubal Cain dyke. (2) Palaeozoic basalt, Moroka snow plains, Mt. Wellington. (3) Hornblende peridotite, Frenchman's Gully near Aberfeldy. (4) Hornblende pyroxene (perknite), Kelly's Cu mine near Walhalla. (5) Rock from Monument Gap, Mt. Wellington. (6) and (7) are 2 of 8 analyses showing the nature and trend of the hydrothermal alterations adjoining the vein walls; (6) showing the compn. of "propylitized diorite porphyrite" 10 ft. distant from a reef [vein] and (7) that of a sample 1 ft. from the reef. Samples (2) and (5) analyzed by Amphit, the others by Junner.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SiO <sub>2</sub>	49.07	49.35	41.43	47.24	51.87	49.65	39.92
Al <sub>2</sub> O <sub>3</sub>	14.88	17.61	5.92	6.63	5.28	16.73	14.81
Fe <sub>2</sub> O <sub>3</sub>	1.64	1.50	4.03	1.53	2.29	0.31	0.61
FeO	8.27	9.72	7.46	8.05	7.37	8.99	5.81
MgO	7.58	3.17	27.59	18.69	22.52	5.88	6.80
CaO	8.17	7.70	4.31	2.92	8.71	7.87	8.28
K <sub>2</sub> O	1.05	1.56	0.64	0.24	0.31	0.80	3.51
Na <sub>2</sub> O	2.87	3.10	0.35	0.55	0.47	3.10	1.41
H <sub>2</sub> O+	2.21	2.56	6.47	2.69	0.97	2.50	1.03
H <sub>2</sub> O-	0.48	0.65	0.32	0.74	0.17	0.14	0.23
TiO <sub>2</sub>	1.46	2.83	0.60	0.65	.....	2.81	1.26
MnO	0.18	0.07	0.42	0.22	0.10	0.14	0.09
Cr <sub>2</sub> O <sub>3</sub>	.....	.....	0.38	0.19	0.21	.....	.....
CO <sub>2</sub>	2.81	.....	0.38	.....	0.21	1.08	16.38
P <sub>2</sub> O <sub>5</sub>	.....	.....	0.24	.....	tr.	0.04	.....
FeS <sub>2</sub>	.....	0.34 NiO = 0.03 (Ni,	.....	.....	.....	.....	.....
		Co) O = 0.07 Cu = 0.66					
		S = 0.09					
.....	.....	.....	.....	.....	.....	.....	.....
100.67	100.16	100.50	100.50	100.54	100.04	100.14	.....

L. W. RIGGS

Studies in contact metamorphism in the Dutch East Indies. H. A. BROUWER. *Delft. Centr. Mineral. Geol.* 1920, 37-45.—B. describes a limestone ejected block from the Semeru volcano, Java; andesite inclusions in a leucitite from the Ringgit Volcano, Java; and granites in contact with sandstones at Rakan and Siak, Java. In the streams of the region cassiterite is common, but it seems to be absent from the pegmatites.

W. F. FOSHAG

The alteration of beerbachite into amphibolite by granite in the southern Black Forest. GEORGE KALB. *Fulda. Centr. Mineral. Geol.* 1920, 148-58.—The amphibolite results from the action of the granite upon beerbachite. An analysis of the amphibolite is given.

W. F. FOSHAG

The globular silica representing the siliceous clay south of the Paris basin. RANDOIN. *Compt. rend.* 172, 1046-9 (1921).—A petrographic study.

L. W. RIGGS

The Alsatian potash deposits (RETZ) 18. Other streams of the valleys of the Don and Loxley (HAWORTH, EVANS) 14. Astigmatic polarization prism for use as an analyzer in the polarizing microscope (EHRINGHAUS) 1. Further Laue methods (GROSS) 1. Analysis of leucites and leucitic minerals (TOMMASI) 7. The solubilities of calcite and aragonite (BACKSTRÖM) 2.

## 9—METALLURGY AND METALLOGRAPHY

D. J. DEMOREST, ROBERT S. WILLIAMS

**Metallurgical progress, or progress in steel treating.** JOS. W. RICHARDS. *Trans. Am. Soc. Steel Treating* 1, 359-64(1921).—An address. W. A. MUDGE

**Industrial uses of aluminium: the thermite process.** GEORGES VIÉ. *Age de fer* 36, 701-3(1920).—Description of the thermite welding process. A. P.-C.

**Cobalt.** ANON. *Mining Sci. Press* 122, 644(1921).—Abstract of a bulletin by the Imperial Mineral Resources Bureau, London. Production and the various uses in glasses, enamels, etc., are reviewed. Advantages of Co plating over Ni plating are claimed: (1) 4 to 15 times as fast, (2) a harder plate, (3) only 25% of amt. used, (4) the plate is more ductile and silvery. A. H. HELLER

**Gases obtained in molten steel.** I, II and III. HENRY D. HIBBARD. *Blast Furnace and Steel Plant* 9, 51-53, 139-40, 193-5(1921).—The paper is based upon the experiences of the writer with open hearth furnaces in this country and abroad and deals with the gases which manifest themselves during steel making operations. A classification of the gases and how to deal with them in order to obtain a sound product are considered. V. O. HOMERBERG

**Molybdenum steel and its application.** M. H. SCHMID. *Chem. Met. Eng.* 24, 927-9(1921).—A detailed description is given of the manuf. of Mo steel, showing the beneficial effects of Mo. Patents are discussed. A table shows the effects of quenching and drawing, and effects on the physical properties by mechanical manipulations. Suggestions for the further use of this alloy steel are made. Also in *Trans. Am. Soc. Steel Treating* 1, 500-5(1920); *Iron Age* 107, 1444-5(1921). E. G. JARVIS

**Another direct process for steel making.** HERBERT LANG. *Iron Age* 107, 1237-8(1921).—The mixt. is contained in a retort and charged into a reverberatory furnace. It varies from the usual process in that the metal is introduced into the reverberatory in a molten form, thus resulting in fuel economy. H. C. PARISH

**Reversion of phosphorus to basic steel in one ladle.** HENRY D. HIBBARD. *Blast Furnace Steel Plant* 8, 642-3(1920).—The fundamental cause of the reversion of P is the presence in the steel of reducing elements (Si, Mn, and C) aided, usually, by the entrance into the slag of  $\text{SiO}_2$  taken up from the acid lining of the ladle. This  $\text{SiO}_2$  sets free from the bases in the slag  $\text{P}_2\text{O}_5$ , which is then reduced by Si, Mn, and C to P and at once absorbed by the steel. The quantity of P to revert depends on 6 factors:—(1) The amt. of P in the charge. The higher the % P in the charge, and hence in the slag, the more P reverts under given conditions. (2) The amt. of erosion of the acid ladle lining. The greater the fluxing of the acid lining (increasing the  $\text{SiO}_2$  in the slag) the greater is the reversion of P. The obvious cure lies in the use of a basic lining. The high cost has thus far prevented this change. (3) The % of reducing elements in the finished steel, chiefly Si, Mn, and C. (4) The quantity of slag retained in the ladle, floating on the metal. The less slag retained in the ladle the less reversion of P takes place. From 4 to 6 inches of slag is the best practice. Such an amt. will usually solidify for the most part and remain quiet. (5) The consistency of the slag. If the slag is thick and hence, motionless reversion is limited to the P in the layer of slag actually in contact with the metal. (6) The length of time the metal is held after tapping until it is all teemed into the molds. This is a consequence of the effect of time on factor (2) above. The first metal teemed has no enrichment; even the first half may have none. The final enrichment is on a constantly decreasing amt. of metal, the max. being in the last metal teemed. LOUIS JORDAN

**Condensation of zinc vapor.** O. RAVNER. *Chem. Met. Eng.* 24, 885-9(1921); cf. C. A. 15, 2063—The elec. furnace for Zn production, while possessing many advantages,

produces larger quantities of Zn dust than do retort furnaces. Pure Zn was distilled in an atm. of CO, of water vapor and of N<sub>2</sub> to det. the effects of these various gases. The temp. of retort and condenser were closely controlled. The amt. of dust for a given condenser temp. is greater the more dil. the Zn vapor. It is probably best to keep the receiver temp. a little above the m. p. of Zn. The Zn vapors should have as short a path as possible from furnace to receiver. The longer the path, the greater is the CO<sub>2</sub> formation and the greater the amt. of Zn dust which results from the reduction of CO<sub>2</sub> with the formation of ZnO. Small amts. of water vapor promote the formation of Zn dust. N<sub>2</sub> reacts with Zn and therefore the reducing agent used in the furnace should contain as little N<sub>2</sub> as possible. The app. should be kept air-tight. As little S as possible should be contained in the charge. Some ZnS may be volatilized or remain in the charge, a loss in either case.

J. H. DARBY

**The nature of zinc dust.** OYSTEIN RAVNER. *Chem. Met. Eng.* **24**, 932-4 (1921); cf. preceding abstract.—Zn dust from spelter furnaces is a light gray powder with a few small metal globules and that from redistn. furnaces is a black powder containing large and small globules of metallic luster. Some of the metallic globules are covered with a gray powder and others have a violet color. Parts having a grain size 0.6-0.13 mm. contain clear white crystals assaying: SiO<sub>2</sub> 61.75, Al<sub>2</sub>O<sub>3</sub> 11.52, ZnO 27.42%. Sp. gr. is detd. by the means employed for cement testing. The liquid used is turpentine. Spelter furnace dust weighs 5.81 g./cc. compared to 6.10 for dust from refined Zn. The spelter furnace dust yields the stronger briquets. One part of Zn dust and 2 parts S flowers ignited burn like gunpowder. Zn dust and I moistened with H<sub>2</sub>O react violently, while ignited in air Zn dust burns to oxide before it melts. Conversion to a button is effected by melting equal quantities of ZnCl<sub>2</sub>, CaCl<sub>2</sub>, and dust with a recovery of 91.6%. The function of the ZnCl<sub>2</sub> is apparently to dissolve the oxide, thus freeing metallic Zn and enabling coalescence.

W. H. BOYNTON

**Effects of metallic structure upon properties.** HENRY S. RAWDON. *Chem. Met. Eng.* **24**, 523-7 (1921).—The structural features of the material are closely related to the mechanical properties. An *Al casting alloy* containing Cu 1.8, Mg 1.7, and Mn 1.2% possesses a continuous network of CuAl<sub>2</sub> throughout the alloy. The course or path of the fracture of a test specimen is detd. by this network. A *Cu and Pb alloy* may be looked upon as a Cu sponge the interstices of which are filled with Pb. The properties measured are essentially those of the Cu sponge. The orientation of test specimen is important. The mechanical properties, when measured across a laminated or fibrous material, will be quite different from those of the same material the test specimen of which was cut parallel to the course of the fibers. The relative size, arrangement and method of distribution of the various constituents that make up the structure of an alloy bear a close relationship to the various properties of the alloy. The soly. of tempered steels according to the heat treatment and the corrosion of *Muntz metal* are discussed. A number of photomicrographs is included. V. O. HOMERBERG

**Fundamentals essential to soundness of steel rails.** GEORGE A. DORNIN. *Chem. Met. Eng.* **24**, 504-5 (1921).—A discussion. V. O. HOMERBERG

**Fundamentals essential to soundness of steel rails.** GEO. F. COMSTOCK. *Chem. Met. Eng.* **24**, 505-6 (1921).—A discussion. V. O. HOMERBERG

**Cupric etching effects produced by phosphorus and oxygen in iron.** J. H. WHITELEY. *J. Iron and Steel Inst.* (advance copy) **1921**, No. 12, 13 pp.—Differences in the P content of less than 0.02% in adjacent parts of otherwise pure Fe can be readily discovered by means of the cupric reagents; as the difference is increased, at any rate up to 0.15%, the contrast becomes more and more pronounced. These differences were produced by first phosphorizing strips of the Fe with P in H at 1000° and then welding in H or other gas, a pile made up of alternate strips of phosphorized and unphosphorized material. Attempts to produce, in a similar way, an unequal distribution of O, which

could be detected by the cupric reagents in the same manner as that of P, were unsuccessful. When O was present, white resist-lines were formed only at the weld junctions, but these resist-lines were not formed when unoxidized Fe was welded in dry H. Two methods of obtaining an unequal O content were used: (a) by soaking pure Fe in its own oxide at a high temp. and then welding it with the unoxidized material; (b) by reducing highly oxidized Fe in H and then welding it with the original metal at a low temp. Also in *Engineering* III, 628-30(1921). V. O. HOMERBERG

**Solid solution of oxygen in iron.** J. E. STEAD. *J. Iron and Steel Inst.* (advance copy) 1921, No. 10, 5 pp.—When Fe is heated in air or oxidizing gases, apparently the surface layers absorb O, which passes into solid soln. When supersatd. the oxide falls out of soln., forming sep. globules of free oxide. These globules then become larger and larger as oxidation proceeds, eventually joining together to form continuous layers. Oxidizing gases find the most facile passage into the steel between the crystals. The gradual changes from solid soln. to free oxide can be clearly traced along the oxidized junctions. S, possibly as  $SO_2$ , in the gases penetrates into the body of the crystals, producing MnS and possibly MnO, which appear in globular form. Also in *Engineering* III, 627-8(1921). V. O. HOMERBERG

**Recent work on chromium-tungsten steel—methods of magnetic analysis.** ANON. *Chem. Met. Eng.* 24, 573-5(1921).—A review of the literature on Cr-W steels, especially the work of Japanese investigators, is given. A description is included of the methods of magnetic analysis extensively utilized. V. O. HOMERBERG

**Magnetic mechanical analysis of manganese steel.** ROBERT HADFIELD, S. R. WILLIAMS AND I. S. BOWEN. *Proc. Roy. Soc. (London)* 98A, 297-302(1921).—A correlation of some of the magnetic and mechanical properties of Mn steel. The steel used contained C 1.25, Si 0.43 and Mn 12.20%. The writers believe that as such data are circulated, it will eventually be possible to interpret from the magnetic behavior of steel what the mechanical properties will be. V. O. HOMERBERG

**Magnetic reluctivity relationship as related to certain structures of a eutectoid-carbon steel.** C. NUSBAUM, W. L. CHENEY AND H. SCOTT. *Bur. Standards, Sci. Paper No. 404*, 739-57(1920).—The very rapid rise of the max. induction in the temp. interval at 150 to 250°, accompanied by heat evolution, viewed in the light of Tammann's law and Honda's expts., indicates that the cementite in this temp. interval is thrown out of solid soln., and thus that in martensite the cementite is in solid soln. It indicates also the completion of a previously suppressed transformation, which completion may be considered as the beginning of the metallographic constituent troostite. The magnetic inhomogeneity within the region A (drawing temp. from 0 to 230°) may be due to one of 2 causes or both, viz., (1) the presence of another constituent, (2) the stresses set up in the material during the quenching operation. The stresses undoubtedly play an important part, but are not necessarily the predominating factor. In region B (drawing temp. from 230 to 460°) the material is magnetically homogeneous. This fact is not an exptl. verification, but is evidence in favor of Benedick's theory of troostite. In region C (drawing temp. 460 to 750°) the material is magnetically non-homogeneous. This inhomogeneity is due to the increasing size of the aggregates and to their approaching stratification. The transition point between regions B and C may be considered as the beginning of the metallographic constituent sorbite. The magnetic reluctivity relationship provides a method for magnetically differentiating the metallographic constituents of the C-Fe series. V. O. HOMERBERG

**Effect of the rate of cooling on the magnetic and other properties of an annealed eutectoid-carbon steel.** C. NUSBAUM AND W. L. CHENEY. *Bur. Standards, Sci. Paper No. 408*, 65-78(1921).—In the paper are presented data showing the influence of various rates of cooling on the magnetic and other physical properties and the resulting metallographic structure of a eutectoid C steel. With decrease in the cooling

rate there is a marked increase in the value of the max. induction for a given value of the magnetizing force, an increase in the magnitude of the max. permeability, and a decrease in the magnitude of the coercive force. As the structure is changed from an essentially sorbitic one, through lamellar pearlite to divorced pearlite, there is a gradual shifting of the break in the reluctivity line toward the origin. Also the difference between the magnitudes of the real and apparent values of the max. intensity of magnetization is greatest when the structure is that of lamellar pearlite. There is a marked agreement between the values of the coercive force and the scleroscope hardness, as influenced by the various cooling rates, except when the specimen is held at a temp. of 650° for a definite time.

V. O. HOMERBERG

**Röntgen spectrographic investigations of iron and steel.** ARNE WESTGREN. *J. Iron and Steel Inst.* (advance copy) 1921, No. 11, 23 pp.—Hull's result that Fe at ordinary temp. ( $\alpha$ -Fe) has a cube-centered lattice structure is verified. At 800° to 830°, that is, within the so-called  $\beta$ -iron interval, the Fe atoms are oriented in exactly the same way as in  $\alpha$ -iron. Allotropy being in the author's opinion equal to polymorphy for solid cryst. bodies, this means that  $\beta$ -iron cannot be considered as a sep. modification of Fe. In austenite and in Fe at 1000° the Fe crystals have face-centered cubic lattices. This is consequently characteristic of  $\gamma$ -iron, and a fundamental difference in crystallographic respect is found between  $\alpha$ - and  $\gamma$ -iron. In martensite Fe is in the form of its  $\alpha$ -modification. This is the case also in high-speed steel of ordinary compn., hardened at 1275°. Also in *Engineering* III, 727-8, 757-9(1921).

V. O. HOMERBERG

**Influence of copper on some physical properties of iron and steel.** E. A. RICHARDSON AND L. T. RICHARDSON. *Chem. Met. Eng.* 24, 565-7(1921); cf. *C. A.* 14, 3630.—Cu added to Fe produces red-shortness over a certain temp. range. The degree of brittleness and the temp. over which it occurs increase with an increase of Cu content. It is believed that this brittleness is due to an intergranular film of Cu or an alloy or compd. of Cu. The red-shortness due to Cu is removed by the addition of Mn or Cr, but the amt. necessary depends on the Cu content. This observation explains why Cu added to Fe causes red-shortness, while it does not cause red-shortness in steel unless added in excessive amts. The addition of Cu up to at least 3.50% apparently does not impair the cold-working properties of the alloys. Beyond 2% of Mn the alloys become too brittle to work, while with more than 2% Cr the alloys become hard and tough.

V. O. HOMERBERG

**Metallography of low-carbon steel.** JAMES MITCHELL. *J. West Scotland Iron Steel Inst.* 28, 38-49(1921).—The structures that are obtained when mild steel sections are examd. microscopically are discussed under the classes angular, acicular, granular and lamellar. Angular structures are associated with cast material. Acicular effects arise from high-temp. reheating and working. This structure by itself should not be taken as a cause of failure. The distribution of the needle-like carbide areas should be uniform and free cementite should be absent. Angular ferrite in large areas is a potential source of danger. The phenomenon of burning is considered at this point since it is associated with the acicular type of structure. Under the granular class, M. considers structures produced by hot working or annealing when the max. temp. does not exceed 1,100° and the min. the critical range. The lamellar group includes the structures commonly met with in rolled materials. The causes for the appearance of *ghost lines* are discussed. Ghosts invariably exhibit non-metallic inclusions in the ferrite lines. A sidelight on the possible causes of the formation of ghosts, apart from segregation, is shown by the microstructure of welds. Even in very low-C material welds are well defined by the presence of a white line. This line does not appear as a result of decarburization of the surfaces prior to welding, even steels with practically no C exhibiting the effect in marked degree, but is due to the soln. of oxides of Fe. A number of micro-photographs is included.

V. O. HOMERBERG

**Cause of quenching cracks.** KÔTARÔ HONDA, TOKUJIRÔ MATSUSHITA and SAKAE INOÉ. *J. Iron and Steel Inst.* (advance copy) 1921, No. 6, 16 pp.—In a quenched steel a certain amt. of austenite is generally present intermingled in martensite. The amt. of this austenite increases as the quenching temp. increases. In small pieces of steel the periphery is harder than the central portion only when the quenching is very soft. In a modern quenching the hardness is everywhere nearly equal, but in a hard quenching the periphery is always softer than the interior. This anomalous phenomenon is explained by the presence of the arrested austenite in martensite. The quenching cracks in small pieces of steel occur when the hardness in the central portion is much greater than in the periphery. The cause of the cracking is attributed to the stress caused by the difference in the sp. vols. of austenite and martensite; the sp. vol. of the former structure being much smaller than that of the latter the central portion exerts a large tangential tension on the periphery, causing thereby the cracking of the specimen. Since the difference in the sp. vols. increases as the temp. falls, the cracking usually takes place when the temp. of the quenched specimen approaches room temp. In a hard quenching, the hardness generally increases with the lapse of time, owing to a gradual transformation of the arrested austenite into martensite. In the case of a large specimen, cracking may take place in the  $A_1$  range, and also in the vicinity of room temp. The cracking at the high temp. is chiefly caused by the stress due to the structural difference between the inner and the outer portions—pearlite and austenite—just below the  $A_1$  point; that at room temp. is due to a similar stress as in the small specimens. Also in *Engineering* 111, 595-7 (1921) V. O. HOMERBERG

**Observations on the corrosion of iron and steel.** [Immersion tests.] J. A. AUF-  
PERLE and D. M. STRICKLAND. *Trans. Am. Electrochem. Soc.* 39, preprint (1921).—Samples of sheet iron were tested at room temp. in a soln. of 0.7%  $H_2SO_4$ , 1.98%  $FeSO_4$  and 0.15%  $Fe_2(SO_4)_3$ . The soln. was kept in circulation by means of an air lift (introduction of  $O_2$ ). After 60 days the corrosion loss of the pure open-hearth Fe sheet was 118 g. per sq. m.; that of the Cu-bearing Fe sheet, 134; plain steel sheet, 259; Cu-bearing steel sheet, 378. The corresponding analyses of these 4 sheets were: S 0.015, P 0.006, C 0.010, Mn 0.012, Cu 0.018; 0.038, 0.006, 0.010, 0.027, 0.304; 0.035, 0.006, 0.100, 0.570, 0.042; 0.035 0.006, 0.100, 0.470, 0.340. Cu-bearing Fe and steel which had resisted atm. corrosion for many years, broke down rapidly in immersion tests. Samples alike in analysis except for Cu content, made from the same heats, indicated that Cu was responsible for the more rapid corrosion of the Cu-bearing samples. Metallic Cu in contact with various kinds of Fe and steel samples had little effect upon the corrosion of any of the samples except the Cu-bearing steel, which was attacked in areas surrounding the Cu contact. Numerous other immersion tests are recorded.

C. G. F.

**Anomalies encountered in a study of immersion tests of iron and steel.** ALLERTON S. CUSHMAN and GEORGE W. COGGESHALL. *Trans. Am. Electrochem. Soc.* 39, preprint (1921).—The progress of corrosion is affected not only by the chemical but also by the physical make-up of the test pieces. There are so many obscure variables that it is very easy to draw false conclusions. Test pieces, 2 in. x 3 in., were cut from three different commercial sheets about 0.47 mm. thick: (1) Cu-bearing steel sheet analyzing 0.04 C; 0.29 Mn; 0.038 S; 0.077 P; 0.20 Cu; 0.015 As. (2) Cu-bearing Fe analyzing, resp., 0.011; 0.032; 0.039; 0.055; 0.251; 0.102. (3) Commercial pure Fe, analyzing, 0.011; 0.015; 0.038; 0.006; 0.038; 0.012. The arsenic content is included in view of the fact that a disproportionate As content might produce some "anti-catalytic" effect during the progress of corrosive reactions. By selecting galvanized sheets of the 3 different types, of as nearly as possible the same gage and weight of coating, and then pickling all samples in concd. HCl until the Zn was all removed, surfaces were obtained which were practically free from etchings. In the first series the test pieces were im-



mersed, separately, in 300 cc. each of 0.1 M  $\text{HgCl}_2$ . After 30 days, immersion the pieces were removed and scrubbed with a brush and water. The 2 Cu-bearing samples were heavily amalgamated; the pure Fe retained its characteristic gray Fe surface. It would appear that "Cu first passes into soln. with the Fe ions and then plates back and forms a mirror surface with the reduced Hg." The pure Fe samples showed least corrosion. The presence of Cu, therefore, "as an alloying constituent of Fe or steel cannot be considered beneficial from an electrochem. point of view." In the tests in solns. of  $\text{K}_2\text{Cr}_2\text{O}_7$  (for details see original), the Cu-bearing samples required 4 to 6 times the concn. of chromate to hold back the soln. pressure and consequent corrosion than in the case of the pure Fe samples. Next, samples were immersed in 20%  $\text{Al}_2(\text{SO}_4)_3$  soln. In the case of the Cu-bearing samples the solns. gelled after three weeks. When the test was repeated with carefully cleaned test pieces little or nothing happened even after 30 days. It appears that the corrosion reactions require some catalytic starter. Galvanized samples passed into soln. very rapidly in the  $\text{Al}_2(\text{SO}_4)_3$  electrolyte. The presence of a little  $\text{ZnSO}_4$  in the  $\text{Al}_2(\text{SO}_4)_3$  soln. brought about rapid corrosion of the clean Cu-bearing samples but had no effect on the pure Fe samples. The partially corroded Cu-bearing pieces showed a higher Cu content than the original samples (0.35% vs. 0.20% Cu). Tests in  $\text{HCl}$ ,  $\text{HNO}_3$  and  $\text{H}_2\text{SO}_4$  were likewise made and in general the Cu-bearing samples corroded more than the pure Fe samples, except in concd.  $\text{HNO}_3$  the Cu-bearing steel was more resistant than the pure Fe. C. G. F.

**The erosion of bronze propellers.** O. SILBERRAD. *J. Soc. Chem. Ind.* **40**, 38-45, 173-4T (1921).—Chem. action was found to be a negligible factor. Galvanic action does not appear to come into play at all. The presence of dirt in the castings has only a slight detrimental effect. The true cause of deterioration is mechanical and it is therefore properly termed erosion, the detg. factors being: (a) the frictional rub of  $\text{H}_2\text{O}$ ; (b) the impinging on the propeller blades of  $\text{H}_2\text{O}$  broken with evacuated spaces which subsequently collapse on the propeller blades, both of which conditions are more likely to arise in high-speed ships or propellers moving at a high velocity. A bronze composed essentially of a  $\beta$  structure is best calcd. to withstand the deterioration considered.

V. O. HOMERBERG

**Erosion of bronze propellers.** N. BELAIEV. *J. Soc. Chem. Ind.* **40**, 58T(1921).—A discussion.

V. O. HOMERBERG

**Erosion of bronze propellers.** WILLIAM RAMSAY. *J. Soc. Chem. Ind.* **40**, 65-6T (1921).—A discussion.

V. O. HOMERBERG

**Miscellaneous alloys of nickel.** PAUL D. MERICA. *Chem. Met. Eng.* **24**, 649-53 (1921).—Ni and any one of the following metals are sol. in all proportions in the solid state: Cr, Co, Cu, Fe, Mn, Pd and Pt. Comprehensive tables are given of the binary alloys of Ni in which the 2 metals form 1 or more compds., binary alloys of Ni having limited miscibility in the liquid state, acid resistance of Ni: Pb alloys, tensile properties of Ni: Al: Cu alloys, corrosion tests of rolled and annealed Ni: Al: Cu alloys, thermoelectromotive force of representative couples, compn. and properties of electrical alloys and miscellaneous alloys containing Ni with reference to the name of the alloy, the chem. compn. and the uses of each.

V. O. HOMERBERG

**Copper-nickel alloys.** PAUL D. MERICA. *Chem. Met. Eng.* **24**, 558-60(1921).—The structure and properties of alloys used for driving bands, condenser tubes and coinage are considered. Various names and analyses for Ni silver are tabulated, with notes upon their most common uses.

V. O. HOMERBERG

**Metal substitution in chemical operations.** E. MAKELT. *Z. Metallkunde* **13**, 33-40 (1921).—Many thousand tons of valuable metals were saved in Germany during the war through replacement by cheaper metals or by other materials. The development of substitutes in the chem. industry is discussed. Cu app. for foods was replaced by enamelled Fe and Siemens-Martin steel. The wide use of Cu in brewing was replaced

by Fe and steel, Cu by Al in wood distn., phosphor bronze and brass by Al in paper making. Stoneware replaced Cu, Pb, Fe and bronze in many industries, such as fire clay in place of Pb in the towers of a  $H_2SO_4$  plant. Pb and Cr-Ni-steel were replaced by ferrosilicon in industries like the  $HNO_3$  and  $H_2SO_4$  industries. C. C. DAVIS

**Description of an apparatus for determining the porosity of metals.** PIERRE BAR-RAND. *Rev. metal.* 18, 161-2(1921).—A translation. See C. A. 14, 2326. W. A. M.

**Modern method of soldering by electric machine.** ANON. *Elec. Rev.* 78, 834(1921).—Detailed illus. account. C. G. F.

**Protection of iron with paint (FRIEND) 26.** Relation between chemical resistance and constitution of alloys (WAGENMANN) 2. Purifying blast-furnace and like gases (Brit. 160,758) 21.

BERGMANN, HEINRICH: *Chemisch-technisches Rezeptbuch für die gesamte Metallindustrie.* Eine Sammlung ausgewählter Vorschriften für die Bearbeitung aller Metalle, Dekoration und Verschönerung daraus gefertigter Arbeiten sowie deren Konservierung. 3rd Ed. revized. Vienna: A Hartlebens, 380 pp. M. 12.

HAUTEBOEUR, LOUIS: *L'agitation des ouvriers métallurgistes en Italie.* Paris: Editions de la Société d'études et d'informations économiques, 282 boulevard Saint-Germain. For review see *Rev. ing. index tech.* 27, 402(1921).

**Recovering zinc and other metals.** RHEINISCH-NASSAUISCHE BERGWERKE AND HUTTEN-ART.-GES. and A. SPIEKER. Brit. 160,455, Feb. 17, 1921. A method of extg. Zn from slags, retort residues, poor ores, etc., consists in treating in a shaft furnace briquets consisting of the material mixed with such a proportion of basic or acid fluxes that the briquets pass through the furnace unchanged until they reach the hottest zone. Zn and Pb are volatilized, and other metals such as Fe, Ni, Co, Cu, Ag, and Au, present in the original material, are obtained in the residue.

**Alloys.** F. MLLIKEN. Brit. 160,708, July 6, 1920. See U. S. 1,354,988 (C. A. 15, 51).

**Alloys; extracting metals.** A. PACZ. Brit. 160,426, March 18, 1921. Alloys are made by the reduction of a double fluoride of Na and another element by means of Al, in the presence of a bath of metal with which the reduced elements alloy. A metal, e. g., a rare-earth metal such as Zr, may be obtained by dissolving out Al from an alloy of Al and Zr so prepd. An alloy of Si and Al may be made by introducing briquets or lumps of a mixt. of powdered  $Na_2SiF_6$ , which may be a by-product from superphosphate manuf., and Al powder, with or without additional Si, into molten Al. The resulting slag of Na and Al fluorides may be used as an electrolyte for obtaining Al. The alloy is refined by means of a fluorine compd. as described in 158,827. By utilizing double fluorides of Na with other elements, alloys of Al with B, Fe, Cu, Zn, Cr, Co, Ni, and other refractory and rare-earth metals may be obtained; and additional elements such as W or Mo may be introduced at the same time by embodying them in the mixt. to be reduced. By utilizing a molten bath other than Al, e.g. Fe, and employing Al and double fluorides of Na and Fe in the briquetted mixt., other alloys, such as alloys of Fe with refractory metals, may be made. 9-10 parts by vol. of coal, etc., and 1 vol. of alk.-earth oxide may be used, and to these may be added small quantities of oxide of iron or oxide of manganese, or salts of these metals. The fuel mixt., before or after briqueting, may be subjected to the action of  $CO_2$  under pressure or to the action of  $CO_2$  in the air. The briquets are finally coated with or soaked in  $Na_2SiO_3$  or the like.

**Alloys; extracting metals; thermoaluminic mixtures.** A. PACZ. Brit. 160,427, March 18, 1921. Briquets or lumps of a mixt. of Al powder and a double fluoride of

Na and a rare earth metal are introduced into molten Al, yielding an alloy of Al with the rare earth metal, and an easily fusible mixt. of fluorides of Na and Al. The alloy or the metal obtained by removing the Al therefrom, is used as the reducing agent in a thermo-reduction mixt. for the production of high temps. or the reduction of refractory metals from their oxides. Alloys rich in B or Zr, *e. g.*, Fe alloys, may be obtained by the thermo-reduction of a mixt. of oxides and an alloy of Al and a rare earth metal.

## 10—ORGANIC CHEMISTRY

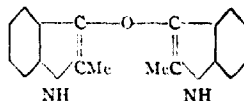
CHAS. A. ROULLER

**2,2-Dimethylchroman.** L. CLAISEN. Lab. L. Claisen, Godesberg a. Rh. *Ber.* **54B**, 200-3(1921).—Monohydric phenols and butadienes undergo an interesting condensation. Thus, PhOH and isoprene on treatment with the proper condensing agents yield, besides alkali-sol. products (phenols), *2,2-dimethylchroman* (A),  $C_{14}H_{16}CH_2CH_2CM_2O$ ,

the structure of which was proved by the following synthesis: 48 g. Et coumarate (obtained in 93% yield of crude and 89% yield of pure product, m.  $87^\circ$ , by Fries and Klostermann's method, *C. A.* **2**, 3066) in 200 g. alc. shaken 3 hrs. with 0.1 g. PdCl<sub>2</sub> and H under 0.75 atm. excess pressure gives 47 g. *o*-HOC<sub>6</sub>H<sub>4</sub>CH<sub>2</sub>CH<sub>2</sub>CO<sub>2</sub>Et, m.  $36-6.5^\circ$ , which, slowly added to 21.4 g. Mg and 124 g. MeI in Et<sub>2</sub>O at  $0^\circ$  and stirred 3 hrs. longer, yields 49 g. *o*-hydroxy- $\gamma$ -dimethyldihydrocinnamyl alcohol, crystals from ligroin, cyclohexane or CHCl<sub>3</sub>, m.  $112-2.5^\circ$ , easily sol. in dil. NaOH; 24 g. of this boiled with 240 cc. of 25% H<sub>2</sub>SO<sub>4</sub> 0.5 hr. and distd. with steam gives 18 g. A, b<sub>11-5</sub>  $988.5^\circ$ , b<sub>760</sub>  $225.2-5.4^\circ$ , d<sub>15</sub><sup>20</sup> 1.009, strongly refractive oil with a penetrating odor reminiscent of BzOEt.

CHAS. A. ROULLER

The indole group. VII. Products of autoxidation of the indoles. BERNARDO ODDO. Univ. Pavia. *Gazz. chim. ital.* **50**, II, 268-75(1920); cf. *C. A.* **11**, 1143.—O. has previously found that indole and some of its Me derivs. undergo transformations which occur readily with  $\alpha$ -methylindole, take place more slowly with skatole and still more so with indole. The product of autoxidation of indole was found to be an indoxyl ether. It gave indirubin by sapon. with HCl, which gives indoxyl from one part and chloroindole and then isatin from the other. In this paper the results with methylketole and skatole are given. Twelve g.  $\alpha$ -methylindole (A) in alc. is at first colorless but exposed to the light in a flask not perfectly closed becomes yellow and with evapn. red-brown. The unchanged A dists. with steam and the nonvolatile residue resembles the product obtained by, autoxidation in the dry state but the yield (2 g.) is much smaller even after 14 months' insolation. 5 g. A spread out and moistened from time to time with an org. solvent gave a better yield of 1.4 g. The product, methylketoxyl (B), was purified from EtOH; yellow prisms, m.  $208-9^\circ$ . The analysis of B corresponds to C<sub>14</sub>H<sub>16</sub>ON<sub>2</sub> and the mol. wt. detd. in Me<sub>2</sub>CO and MeOH was 280.5 and 277.9, resp. B is, therefore, thought to be



(Plancher, Colacicchi, *C. A.* **5**, 3403), since one of the 2 other possible formulas is excluded because B gives dihydromethylketole on reduction and the *N*-oxyindole formula is excluded because B is yellow and because of its color reaction with H<sub>2</sub>SO<sub>4</sub> + AcOH. In order to test this further O. detd. the active H in B with EtMgI (cf. *C. A.* **5**, 3423). The value for active H obtained was 1.78 while 2.0 was calcd. for the formula C<sub>14</sub>H<sub>16</sub>N<sub>2</sub>.

$O(NH_3)_2$ . The  $EtMgI$  was prepared from anhydrous iso-Am ether in  $C_4H_9N$  (purified over fresh  $BaO$  and distd. after filtration in the presence of a drop or 2 of fuming  $H_2SO_4$ ). The  $EtOH$  soln. of skatole at first colorless becomes brown-red, and on evapn. is gummy, but when pulverized shows crystals under the microscope. The purification was difficult. The unchanged skatole was eliminated by steam distn. and the nonvolatile part was collected on a filter but skatole was still present. It was then fractionally crystd. from  $EtOH$  and  $H_2O$ . The 1st fraction, m.  $120-30^\circ$ , contained skatole; the 2nd fraction was not pure but m.  $223^\circ$  (decomp.  $235^\circ$ ). Recrystd. 3 times from  $C_4H_8$  with ligroin 0.03 g. product (C) was obtained from 5 g. skatole as a dark brown powder, m. about  $245^\circ$  (decompn.). Satisfactory results in the prepn. of C were not obtained by other methods. Qual. tests give results analogous to those for B. E. J. W.

**Preparation of tetrachloroethane and trichloroethylene from acetylene and chlorine.** SADA0 IGI. *J. Chem. Ind. Japan* 23, 1217-37(1920).—In order to develop processes for the utilization of Cl and carbide, I. exptd. with various methods of prepn. of  $C_2H_2Cl_4$  and  $C_2HCl_3$  from Cl and  $C_2H_2$ , and studied the properties of these compds. The conclusions are: (1)  $C_2H_2Cl_4$ . The use of  $SbCl_5$  as catalyzer is best. The optimum temp. for absorption of Cl is  $80-100^\circ$ , and for  $C_2H_2$   $60-80^\circ$ . During the introduction of  $SbCl_5$ ,  $SbCl_3$  and  $C_2H_2Cl_4$  are formed; Cl acts on  $SbCl_3$  producing  $SbCl_5$ . The efficiency of  $SbCl_5$  as a catalyzer is maintained for a long time in both processes. With 100 g.  $SbCl_5$ , 150-80 g. of the gas can be obtained. This method offers two difficulties in industrial operation: (a) Decrease of the absorption power of  $SbCl_5$ , and difficulty of its recovery, (b) danger of explosions. Various methods for avoiding these difficulties are given. (2)  $C_2HCl_3$  is best prepd. by boiling  $C_2H_2Cl_4$  with  $Ca(OH)_2$ . The amt. of lime and  $H_2O$  should be in excess—60 g. of  $Ca(OH)_2$  and 50 g. of  $H_2O$  for each 100 g. of the  $C_2H_2Cl_4$ . By this method an 84% yield is easily obtained. Necessary characteristics for these compds., compared with  $CCl_4$  and petroleum benzine as org. solvents, are given in a table.  $C_2H_2Cl_4$  rusts metals when wet, but  $C_2HCl_3$  will not, making it a good solvent, therefore, in oil extn. in metallic containers. Various org. compds. which can be prepd. from these are enumerated. S. T.

**Mercury dibutyl and some of its derivatives.** JULES TIFFENEAU. *Bull. sci. pharmacol.* 28, 65-8(1921).— $HgBu_2$  is a colorless liquid, d. 1.817, insol. in  $H_2O$ , sol. in most org. solvents, forms in alc. with  $AgNO_3$  a red-brown ppt. on heating.  $BuHgOH$  crystals, in flakes, m.  $47^\circ$ , is very sol. in  $H_2O$  and  $EtOH$ . Its solns. are strongly alk., and displace  $NH_4$  from salts, are stable in the cold, but decomp. on heating with the liberation of free Hg. The different acids sat. the solns. of the compd. with the formation of the respective salts which are insol., as the halogen salts, or sol., as the acetate salts. The compd.  $BuHgSH$  which is formed when  $H_2S$  is passed through the hydroxide in  $H_2O$  is almost insol. in  $Et_2O$  and m. about  $59^\circ$ . The fluoride,  $BuHgF$ , is a cryst. compd. sol. in cold  $EtOH$ , m.  $147^\circ$  and is almost insol. in  $H_2O$ . The chloride, formed by the action of HCl on the hydroxide, is a cryst. compd. m.  $125.5^\circ$ , almost insol. in  $H_2O$ , slightly sol. in  $EtOH$ , and sol. in  $Et_2O$  and  $C_6H_6$ . The toxicity on the dog is about 0.04-0.05 g. per kg. With this dose death occurs in 1-2 days, and is preceded by symptoms of gastro-intestinal irritation. The bromide, iodide and cyanide similarly prepd. from their respective acids, are cryst. compds. m.  $128^\circ$ ,  $114^\circ$ , and  $40^\circ$ , resp. The acetate as prepd. occurs in fine needles, strongly hygroscopic, m. at  $50-1^\circ$ .

F. S. HAMMETT

**Constitution of linolic acid.** KATSUMI TAKAHASHI. *J. Chem. Soc. Japan* 42, 130-41(1921).—Goldsobel (cf. C. A. 1, 1805) considers linolic acid to be 9,12-diketostearic acid, basing his conclusion on the fact that sativic acid, when oxidized with  $KMnO_4$ , produces caproic, azelaic and oxalic acids. T. investigated the position of the 2 double bonds in linolic acid by two different methods of oxidation, alk.  $KMnO_4$  and  $O_3$ . The acid is obtained from oils of soy bean and bran and is brominated. The tetrabromo

stearic acid is repeatedly purified according to Rollet's method. The final product C, 11.77% H, 11.31% O, the av. mol. wt. 280.15. When 20 g. of the acid is b<sub>16</sub> 230-1°, did not solidify at -10°, Wijs no. 179.2 (theoretical 181.4), 77.14% boiled with 20 cc. KOH (23%), and oxidized with KMnO<sub>4</sub> (21. of hot H<sub>2</sub>O and 11. of 4% KMnO<sub>4</sub>), in alk. medium at 80-5° for about 2 hrs., 1.8 g. of sativic acid, 2.2 g. of azelaic acid, 1.8 g. of butyric acid and a trace of glutaric acid are obtained. Oxidation of sativic acid (m. 173°), by alk. KMnO<sub>4</sub> also gives azelaic, butyric and a trace of glutaric acid. Oxidation by O<sub>3</sub> was next tried. Linolic diozonide is prepd. by passing O<sub>3</sub> into a CHCl<sub>3</sub> soln. of the acid at 0°. When 20 g. of the ozonide is treated with boiling H<sub>2</sub>O, there is obtained 1.30 g. PrCHO, 1.20 g. PrCO<sub>2</sub>H, 1.05 g. filutaric dialdehyde, 1.00 g. glutaric acid, 8.22 g. of azelaic acid and aldehyde, 1.41 g. of unknown substance, and 5-6 g. loss. From these analyses, T. believes that linolic acid is 9,14-diketostearic acid, Me(CH<sub>2</sub>)<sub>7</sub>CH:CH(CH<sub>2</sub>)<sub>7</sub>CO<sub>2</sub>H. S. T.

The preparation of metal salts of thioglycolic acid. C. N. MYERS. Hyg. Lab. Washington, D. C. *J. Lab. Clin. Med.* 6, 359-73(1921).—The object of the investigation was to prep. a series of salts with a common, non-toxic anion, by the use of which physiol. effects of a number of metals in combination with that ion could be studied. Metal salts were prepd. from NaHSCH<sub>2</sub>CO<sub>2</sub>Na. HSCH<sub>2</sub>CO<sub>2</sub>H was prepd. by heating CH<sub>2</sub>ClCO<sub>2</sub>H with KSH, acidifying, and extg. the free acid with ether. The salt HSCH<sub>2</sub>CO<sub>2</sub>Na was always made up freshly for the preps. by exact neutralization with NaOH. In general acids of the type RSCH<sub>2</sub>CO<sub>2</sub>H (R = metal) were prepd. on the acidification of a clear mixt. formed on the soln. of a metal salt or hydroxide in this Na salt. These were for the most part cryst. substances, readily sol. in water, but decomp. in aq. soln., especially in light, with the production of a metallic sulfide. Salts of the type RSCH<sub>2</sub>CO<sub>2</sub>Na were prepd. by the addition of abs. alc. to solns. of the metallic oxides in HSCH<sub>2</sub>CO<sub>2</sub>Na. The following compounds were prepd.: Bi(SCH<sub>2</sub>CO<sub>2</sub>H)<sub>3</sub>, CuSCH<sub>2</sub>CO<sub>2</sub>H, RbSCH<sub>2</sub>CO<sub>2</sub>Na.2H<sub>2</sub>O, AgSCH<sub>2</sub>CO<sub>2</sub>Na, AuSCH<sub>2</sub>CO<sub>2</sub>Na.H<sub>2</sub>O, BeSCH<sub>2</sub>CO<sub>2</sub>Na, Cd(SCH<sub>2</sub>CO<sub>2</sub>Na)<sub>2</sub>.4H<sub>2</sub>O, Hg(SCH<sub>2</sub>CO<sub>2</sub>H)<sub>2</sub>, Tl(SCH<sub>2</sub>CO<sub>2</sub>H)<sub>3</sub>, Ce(SCH<sub>2</sub>CO<sub>2</sub>Na)<sub>3</sub>, Pb(SCH<sub>2</sub>CO<sub>2</sub>Na)<sub>2</sub>.2H<sub>2</sub>O, V<sub>2</sub>(SCH<sub>2</sub>CO<sub>2</sub>Na)<sub>3</sub>.2H<sub>2</sub>O, As(SCH<sub>2</sub>CO<sub>2</sub>Na)<sub>3</sub>.H<sub>2</sub>O, Sb(SCH<sub>2</sub>CO<sub>2</sub>Na)<sub>3</sub>, Mo(SCH<sub>2</sub>CO<sub>2</sub>Na)<sub>4</sub>.2H<sub>2</sub>O, W(SCH<sub>2</sub>CO<sub>2</sub>Na)<sub>4</sub>.2H<sub>2</sub>O, UO<sub>2</sub>(SCH<sub>2</sub>CO<sub>2</sub>Na)<sub>2</sub>.4H<sub>2</sub>O, Ni(SCH<sub>2</sub>CO<sub>2</sub>Na)<sub>2</sub>.4H<sub>2</sub>O, Co(SCH<sub>2</sub>CO<sub>2</sub>Na)<sub>2</sub>.6H<sub>2</sub>O, Pt(SCH<sub>2</sub>CO<sub>2</sub>H)<sub>4</sub>, and Zn(SCH<sub>2</sub>CO<sub>2</sub>Na)<sub>2</sub>.H<sub>2</sub>O.

E. R. LONG

Tartaric acid from tamarinds. J. J. SUDBOROUGH AND P. N. VRIDHACHALAM. *J. Indian Inst. Sci.* 3, 61-80(1920).—Tamarind pulp contains about 12-14% of tartaric acid, part of which is in the free state and part as K bitartrate, and the possibility of the com. utilization of tamarinds in India as a source of this acid is suggested. The acid can easily be recovered by the methods used in the production of tartaric acid from wine lees, provided the pulp is first heated for 1 hr. at 160° in an autoclave in order to render the expressed liquor capable of being readily filtered. The yields of pure recrystd. acid obtained on a technical exptl. scale amounted to about 6% on the wt. of the pulp, and, in addition, about 1.7% as pure K bitartrate. A certain amt. can also be recovered from the final mother liquors as Ca tartrate. J. S. C. I.

The optical rotation of dextrose under the influence of hydrochloric acid. II. Changes in the rotation and reduction capacity of dextrose solutions in hydrochloric acid at 100°. HANS MURSCHHAUSER. *Biochem. Z.* 116, 171-90(1921); cf. C. A. 14, 2777.—This paper is a report of the data described in the title and is presented in many tables and curves. When 5, 10, or 20% dextrose solns. are treated at 100° with 5.1, 8.06 and 10.1% HCl changes in the reduction and rotation capacity occur. The rotation increases at first up to a certain max. and from then on a decrease takes place during the course of the heating. The max. of the  $\alpha_D$  increase is higher with the 20% than with the 10% soln. but is the same for the different HCl concns. The decrease in rotation accompanying continued heating is practically linear from the max. In

solns. of equal dextrose concn. the slope of the curve is steeper the stronger the HCl, *e. g.*, the velocity of destruction increases with the acidity, but the slopes of the curves of similar HCl concn. with different dextrose concns. are almost parallel. The reduction capacity also decreases in a linear direction with the period of heating after the first 2 hrs. In the first quarter to half hr. the decrease, particularly in 20% dextrose, is much greater than in the later periods. In 10% soln. the decrease is less. The period when the rotation increases and reduction capacity decreases is explained on the basis of an isomaltose or polysaccharide formation; in the latter periods of heating the rotation capacity is always more strongly decreased than is the reduction capacity, though the curves tend to approach each other. In 5% dextrose soln. the isomaltose formation in different HCl concns. is quite small though the phenomena in general are the same as with the 10 and 20% solns.; the % rotation decrease is greater, the reduction capacity decrease less than in the corresponding 10% dextrose solns. and the curves approach each other more closely. The max. of the rotation increase is not dependent on the acid but on the dextrose concn. though the time at which the max. is attained is dependent on the amt. of HCl present. F. S. HAMMETT

**The reduction stages of aryl derivatives of nitric acid.** KURT H. MEYER AND WALTER REPPH. *Akad. Wiss. München. Ber.* 54B, 327-37 (1921).—Most phenol ethers with  $\text{HNO}_3$  give, besides the  $\text{NO}_2$  derivs., peculiar, deeply colored oxonium salts derived from *N*-diarylhydroxylamine *N*-oxides (A), like  $(\text{MeOC}_6\text{H}_4)_2\text{N}(\text{:O})\text{OH}$ , which are not known in the free state but rearrange into a quinoid form (B),  $\text{MeOC}_6\text{H}_4\text{N}(\text{:O})\text{:}(\text{ClO}_4)\text{Me}$ . By moderate reduction these compds. are converted into the oxides  $\text{R}_2\text{NO}$  which on complete reduction give the corresponding amines (*C. A.* 14, 1533); the new compds. can be regenerated from the oxides by oxidation. A more thorough study has now been made of the individual stages of the reduction and of the decompn. of the free A. If the colored salts are treated in  $\text{H}_2\text{O}$  with aq. alkali or in  $\text{CHCl}_3$  with dry alkali, the deep dark color changes to a bright red; the velocity of this change depends on the substituents on the phenol nucleus; the stability towards  $\text{C}_6\text{H}_5\text{N}$  shows a similar variation. The free oxonium hydroxides, which are stable for only a short time, rearrange into the pseudo bases A which, however, at once decomp., one mol. oxidizing the other and yielding the oxide (45%) and another product which has not been identified:  $2\text{R}_2\text{N}(\text{:O})\text{OH} \rightarrow \text{R}_2\text{NO} + \text{unknown oxidation product}$ . Gentle reduction of the colored salts with Zn dust in alc. or with NaI in  $\text{Me}_2\text{CO}$  smoothly gives the oxides  $\text{R}_2\text{NO}$ , well crystd. bright red or brown-red compds., sol. in neutral media with orange-red to red colors, showing no band spectrum. While the colored oxonium salts with quinquevalent N are stable towards mineral acids but decompd. by alkalis, the reverse is true of the oxides with quadrivalent N; mineral acids at once decomp. them according to the scheme  $2(\text{MeOC}_6\text{H}_4)_2\text{NO} \xrightarrow{\text{HCl}} (\text{MeOC}_6\text{H}_4)_2\text{NOH} + \text{MeOC}_6\text{H}_4\text{N}(\text{:O})\text{:C}_6\text{H}_4\text{:OCIMe}$ ; the hydroxylamine slowly undergoes further decompn. into the amine and the oxide which again at once decomp., so that the final products are the amine and the colored salt. The diarylhydroxylamines are smoothly obtained by reduction with  $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$  or  $\text{PhNHNH}_2$ ; they easily decomp. according to the equation  $3\text{R}_2\text{NOH} = 2\text{R}_2\text{NO} + \text{R}_2\text{NH} + \text{H}_2\text{O}$  and in many cases cannot be isolated. They are more stable in the form of their quinoid, deeply colored salts with mineral acids,  $\text{MeO} \cdot \text{C}_6\text{H}_4\text{:O}(\text{ClO}_4)\text{Me}$ .  $\text{PbO}_2$  in neutral solvents easily converts the hydroxylamines into the oxides  $\text{R}_2\text{NO}$ . Reducing agents in acid solns. convert all the intermediate reduction products into the amines,  $\text{R}_2\text{NH}$ , but it is not possible to regenerate the intermediate products from the last ones by oxidation; the most varied oxidizing agents yield only the deeply colored salts of the corresponding tetraarylhydrazines. The compds. studied by M. and R., therefore, resemble the inorg. reduction stages of  $\text{HNO}_3$  far more closely than Wieland's nonmethoxylated compds. (*C. A.* 14, 2637). But the

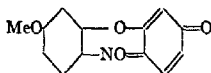
behavior towards acids and alkalis of the org. and inorg. derivs. is directly opposite, because the inorg. 5- and 3-valent N derivs.,  $\text{HNO}_2$  and  $\text{HNO}_3$ , are acids which are fixed and stabilized by alkalis, while the diaryl derivs. behave like bases and are therefore bound by acids and formed under their influence. *Di-p-anisylhydroxylamine N-oxide*, from 1 g. of B in 40 cc. ice-cold  $\text{Me}_2\text{CO}$  shaken with 0.2 g. Zn dust until the deep red-violet color has changed to brown-red, filtered and cautiously treated with 40 cc. ice  $\text{H}_2\text{O}$ , leaflets, sinters  $120^\circ$ , m.  $150^\circ$  (decompn.); yield, 0.42 g.; 0.5 g. in 10 cc.  $\text{CHCl}_3$  treated with a soln. of 0.6 g. Br and then slowly with 20 cc. cold  $\text{Et}_2\text{O}$  gives 0.7 g. of the quinoidal *perbromide* of *di-p-anisylhydroxylamine N-oxide*,  $\text{MeOC}_6\text{H}_4\text{N}(\text{O})\text{C}_6\text{H}_4\text{O}(\text{Br}.\text{Br})\text{Me}$ , crystals with Cu luster from a little  $(\text{CHCl}_3)_2$  or  $\text{Me}_2\text{CO}$  and  $\text{Et}_2\text{O}$ , m.  $116^\circ$  (decompn.), quantitatively reduced in AcOH by NaI to  $(\text{MeOC}_6\text{H}_4)_2\text{NH}$ . *N-di-p-anisylhydroxylamine* (0.1 g. from 0.2 g. of the oxide in 1 cc. MeOH treated with 0.9 cc. of a soln. of 5 g.  $\text{PhNHNH}_2$  in 100 cc. MeOH), needles from  $\text{C}_6\text{H}_6$ -ligroin, quantitatively reduced by AcOH-NaI to the amine, becomes reddish at  $80^\circ$ , intensely red at  $80^\circ$ , dark brown on further heating and m.  $118^\circ$  to a brown-red liquid in which the oxide can be detected; the cold colorless solns. in  $\text{C}_6\text{H}_6$ , MeOH and  $\text{Et}_2\text{O}$  gradually turn brown-red, immediately on boiling, as do also the cold solns. in  $\text{CHCl}_3$  and  $(\text{CHCl}_3)_2$  (possibly owing to traces of acids); the red color is due to decompn. into 2 mols. oxide and 1 mol. amine. The hydroxylamine dissolves in concd. acids with pure blue color, doubtless owing to the formation of oxonium salts which are quickly hydrolyzed by  $\text{H}_2\text{O}$ ;  $\text{PbO}_2$  in neutral solvents at once converts the hydroxylamine into the oxide; both the hydroxylamine and the oxide are at once reduced to the amine by  $\text{PhNHNH}_2$  in AcOH. *2,6,2',6'-Tetramethyl-4,4'-dimethoxydiphenylhydroxylamine N-oxide* (0.64 g. from 1 g. of the quinoidal perchlorate of the hydroxylamine N-oxide treated with 0.5 g. NaI in 10 cc. MeOH and then with 5 cc.  $\text{Et}_2\text{O}$ ), garnet-red crystals from  $\text{Me}_2\text{CO}$ , m.  $163^\circ$ , sol. in AcOH (without change) with red, in mineral acids with deep green color. *Diphenylamine*, crystals from MeOH, m.  $128^\circ$ . When the quinoid perchlorate of  $[2,4-(\text{MeO})_2\text{C}_6\text{H}_3]\text{N}(\text{O})\text{OH}$  in MeOH is treated with NaI the color changes to red but on cooling there sep., instead of the expected oxide, the steel-blue needles of a periodide (see below); if the excess of I is removed with Zn the reduction at once proceeds farther. Only when the MeOH soln. is treated with much  $\text{Et}_2\text{O}$  after the color has changed and it is strongly cooled are there obtained the characteristic red prisms of the oxide which turn green when drained. Quinoidal *2,3,2',3'-tetramethoxydiphenylhydroxylamine N-oxide periodide*, steel-blue needles, m.  $124^\circ$  (decompn.). If the quinoidal perchlorate is shaken in  $\text{Me}_2\text{CO}$  with powdered KOH until it changes to red and is then filtered into an excess of 20% aq.  $\text{HClO}_4$ , the quinoidal *hydroxylamine perchlorate* seps., dark blue crystals with 1  $\text{H}_2\text{O}$  from  $(\text{CHCl}_3)_2\text{-Et}_2\text{O}$ , m.  $175^\circ$  (decompn.), easily sol. with blue-green color in  $\text{CHCl}_3$ ,  $\text{Me}_2\text{CO}$  and MeOH, gives a red color with alkalis. *Octa-methoxytetraphenylhydrazine diperchlorate*, from  $[2,4-(\text{MeO})_2\text{C}_6\text{H}_3]\text{NH}$  shaken with  $\text{PbO}_2$  in MeOH and filtered into 20%  $\text{HClO}_4$ , also obtained with  $\text{FeCl}_3$ , light blue needles from  $(\text{CHCl}_3)_2\text{-Et}_2\text{O}$ , m.  $194.5^\circ$  (decompn.), easily sol. with corn-flower blue color in  $\text{PhOH}$ ,  $\text{PhNO}_2$ ,  $\text{BzMe}$  and  $(\text{CHCl}_3)_2$ , at once gives a red color with alkalis.  $\text{PhNH}_2$  and  $\text{C}_6\text{H}_5\text{N}$ , slowly decomp. in soln., smoothly regenerates the amine on reduction, mol. wt. in freezing  $\text{BzMe}$  703.4 and, after 45 min., 255. *2,2'-Dimethyl-4,6,4',6'-tetramethoxydiphenylhydroxylamine N-oxide* (0.6 g. from 1 g. of the quinoidal perchlorate of  $[\text{Me}(\text{MeO})_2\text{C}_6\text{H}_3]\text{N}(\text{O})\text{OH}$  in 5 cc.  $\text{Me}_2\text{CO}$  treated with NaI in  $\text{Me}_2\text{CO}$  until the color changes to red), garnet-red prisms from  $\text{Me}_2\text{CO}$ , m.  $175^\circ$  (decompn.), easily sol. in  $\text{Me}_2\text{CO}$  and  $\text{CHCl}_3$  with brownish red, in AcOH and concd. mineral acids with deep green color, the AcOH soln. turning to an impure violet on warming, mol. wt. in freezing  $\text{CHBr}_3$  326.9-340.6, gives a red-violet compd. with  $\text{PhMgBr}$  in  $\text{Et}_2\text{O}$ , easily reduced to the amine, m.  $106.5^\circ$ , gives with Br in  $\text{CHCl}_3$  the quinoidal *hydroxylamine N-oxide perbromide*, deep black needles sol. in  $\text{Me}_2\text{CO}$  with deep green color. *Hydroxyl-*

amine, m. (crude) 145°, is even less stable than the dianisyl compd. and quickly turns yellow-red in neutral solvents, even in the cold. The oxide (0.5 g.) in 15 cc. AcOH filtered into 30 cc. of 20% HClO<sub>4</sub> gives 0.26 g. of the hydroxylamine oxide perchlorate, the faintly greenish filtrate from which contains the hydroxylamine as shown by the liberation of I from HI, with formation of the amine. 2,4,6,2',4',6'-Hexamethoxydiphenylnitrogen oxide (0.3 g. from 0.5 g. of the crude nitrate obtained from C<sub>6</sub>H<sub>5</sub>(OH)<sub>3</sub> with 40% HNO<sub>3</sub> (Mannich, *Arch. Pharm.* 242, 501 (1904)) dissolved in 50 cc. of 10% NaHCO<sub>3</sub>, brick-red crystals, decomp. 194°, sol. in acids, including dil. AcOH, with blue color.

CHAS. A. ROULLER

**Action of nitric acid on phenols and phenol ethers.** KURT H. MEYER AND W. E. ELBERS. *Akad. Wiss. München. Ber.* 54B, 337-46 (1921); cf. *C. A.* 14, 936, 1533.—The similarity in behavior of phenols and of phenol ethers towards various reagents, such as halogens, HNO<sub>3</sub>, diazo compds., aldehydes, etc. (*C. A.* 8, 2878), led M. and E. to det. whether free phenols would react with HNO<sub>3</sub> like their ethers (cf. preceding abst.). As a result of their work they conclude that in both cases there are two competing reactions, *vis.*, formation of NO<sub>2</sub> derivs. from 1 mol. each of HNO<sub>3</sub> and phenol (or its ether) and of indophenol oxides or the quinoid dye salts from 1 mol. HNO<sub>3</sub> and 2 mols. phenol. Whether the reaction proceeds to the greater extent in the one direction or the other is detd. chiefly by the substituents in the phenol and these substituents (alkyl, alkoxyl, etc.) have the same influence in the ethers as in the free phenols. The reactions of the phenols must therefore be considered from the same point of view as those of their ethers and the greater reactivity of the phenols cannot be explained on the basis of a hypothetical keto form. *Indophenol N-oxide* (A), HOC<sub>6</sub>H<sub>4</sub>N(O):O: C<sub>12</sub>H<sub>7</sub>O (yield, 1.2 g. crude and 0.6 g. pure product from 20 g. PhOH), is prepd. from 5 g. PhOH in 20 cc. AcOH treated with 10 cc. concd. H<sub>2</sub>SO<sub>4</sub> in 20 cc. AcOH, then dropwise with 4 cc. colorless concd. HNO<sub>3</sub> at 15-20° (the resulting soln. must be deep violet-red), poured into 200 cc. ice H<sub>2</sub>O, extd. with Et<sub>2</sub>O until the exts. are no longer colored red by concd. HCl (about 500 cc. Et<sub>2</sub>O), shaken with concd. NaHCO<sub>3</sub>, then with ignited Na<sub>2</sub>SO<sub>4</sub>, concd., treated a short time with HCl to ppt. the red-violet HCl salt, filtered, decompd. on the filter with ice H<sub>2</sub>O, dried and crystd. from CHCl<sub>3</sub>-ligroin; it seps. in brown-red spears carbonizing without melting sharply, sol. in concd. H<sub>2</sub>SO<sub>4</sub> with a characteristic violet-red color changing in a few hrs. into the blue of indophenol sulfate; the violet-red soln. in concd. HCl slowly becomes colorless; HCl in neutral mediums ppts. a red-violet oxonium salt; alkalis dissolve A without change with dark blue color; Na<sub>2</sub>S<sub>2</sub>O<sub>4</sub> or Zn dust with a little AcOH in CHCl<sub>3</sub> reduce it to the auto-oxidizable (*p*-HOC<sub>6</sub>H<sub>4</sub>)<sub>2</sub>NH, the soln. depositing, in the air, on the addition of ligroin pure indophenol, m. 160°; PhNHNH<sub>2</sub> reduces it with evolution of N. *O-Benzoyl* (0.6 g. from 0.7 g. A shaken 2 hrs. in soda with 1 cc. BzCl), orange to brown leaflets from CHCl<sub>3</sub>-ligroin, m. 174.3° sol. in concd. HCl with red, in H<sub>2</sub>SO<sub>4</sub> (probably with hydrolysis) with violet-red color. *o*- and *m*-Cresol similarly treated give red-violet HCl salts of the corresponding indophenol oxides in the same yield as PhOH; *p*-cresol gives only a dirty brown color. 1,3,5-Xylenol on nitration in AcOH-H<sub>2</sub>SO<sub>4</sub> forms a deep green soln.; the HCl salt of the indophenol oxide is deep green, with a strong Cu luster, and sol. in HCl with green color; the free oxide dissolves in dil. alkalis with dark green-blue color. 2,2'-Dimethyl-5,5'-diisopropylindophenol *N-oxide hydrochloride* (0.3 g. from 5 g. thymol in 20 cc. AcOH, 5 cc. H<sub>2</sub>SO<sub>4</sub> in 20 cc. AcOH and 5 cc. HNO<sub>3</sub> at 20-5°), green crystals with Cu luster from alc.-free CHCl<sub>3</sub> containing HCl, m. 110° (decompn.), decompd. by 50 % alc. into the free oxide, red leaflets with green luster from CHCl<sub>3</sub>-ligroin, m. 168°, sol. in concd. H<sub>2</sub>SO<sub>4</sub> with blue color very quickly changing to bright green, changed to green, without dissolving, by concd. aq. HCl, sol. in alc. HCl with blue, in alkalis with dark blue color. 7-Methoxyphenoxazone 2-N-oxide





(0.8 g. from 5 g. *m*-MeOC<sub>6</sub>H<sub>4</sub>OH in 20 cc. AcOH at 10° treated with 1 drop fuming and then slowly with 4 cc. pure HNO<sub>3</sub>), deep dark brown-red needles from (CHCl<sub>3</sub>)<sub>2</sub>, m. about 252° (decompn.), insol. in alkalis, decompd. on boiling, sol. in concd. mineral acids with fuchsin-red color, converted by HCl in CHCl<sub>3</sub> into a dark red *dihydrochloride* gradually losing HCl *in vacuo* and passing into a stable *monohydrochloride*, reduced by PhNHNH<sub>2</sub> and by HI in AcOH, converted by alk. Na<sub>2</sub>S<sub>2</sub>O<sub>4</sub> into the colorless amine which rapidly auto-oxidizes to *7-methoxy-2-phenoxazone*, brick-red needles, m. 247°, sublimes without decompn., sol. in concd. H<sub>2</sub>SO<sub>4</sub> with blue, in concd. HCl with red color, yields with HCl in CHCl<sub>3</sub> a dark red *hydrochloride* dissociating at 170°, gives with SnCl<sub>2</sub> a red salt, slowly forms (probably with rupture of the bridge) a deep violet color with alc. KOH, acids regenerating the phenoxazone, is not oxidized back to the phenoxazone oxide by HNO<sub>2</sub>, HNO<sub>3</sub>, PbO<sub>2</sub> or H<sub>2</sub>O<sub>2</sub> in AcOH, so that the phenoxazone cannot be an intermediate product in the formation of the oxide. *A priori* the possibility was not entirely excluded that HOC<sub>6</sub>H<sub>4</sub>NO<sub>2</sub>, first formed, might condense with unchanged PhOH to the oxide, but neither HOC<sub>6</sub>H<sub>4</sub>NO<sub>2</sub> nor MeOC<sub>6</sub>H<sub>4</sub>NO<sub>2</sub> could in any way be made to condense with PhOH or PhOMe. It was also conceivable that HOC<sub>6</sub>H<sub>4</sub>NO might first be formed by traces of HNO<sub>2</sub> and that this then yielded indophenol which was oxidized to the oxide, but here again it was found impossible to oxidize any indophenol to the oxide. There remain but 2 possibilities: the simultaneous reaction of 1 mol. HNO<sub>2</sub> with 2 mols. of the phenol (trimol. reaction) or its combination with 1 mol. phenol to a labile intermediate product which then condenses with another mol. of the phenol (dimol. reaction); a kinetic expt. with *m*-C<sub>6</sub>H<sub>4</sub>(OH)<sub>2</sub> (the course of the reaction being followed colorimetrically) indicates that the latter is the correct view.

CHAS. A. ROULLER

**Relations among azoxy derivatives and diazo compounds.** A. ANGELI. *Gazz. chim. ital.* 51, I, 35-42 (1921).—In a previous paper (C. A. 12, 364) A. showed that the azoamide, PhN:NCONH<sub>2</sub>, among other azo derivs. in AcOH soln. with H<sub>2</sub>O<sub>2</sub> gives PhN(:O):NCONH<sub>2</sub>, which was the 1st azoxyamide known and which is easily transformed into the diazo compd. Even in dil. aq. soln. in presence of a trace of alkali it gives the scarlet-red azo compds. with  $\beta$ -naphthol. Only after prolonged heating does the liquid fail to react with naphthol, because it has become isodiazotized. A. has now studied the behavior of some azoxyphenols, Ph(N<sub>2</sub>O).C<sub>6</sub>H<sub>4</sub>OH. The *p*-substituted exist in 2 forms, PhN(:O):NC<sub>6</sub>H<sub>4</sub>OH (A), m. 156°, and PhN:N(:O):C<sub>6</sub>H<sub>4</sub>OH (B), m. 118° (C. A. 9, 65). 4 g. A in a little H<sub>2</sub>O made alk. with KOH was treated with 2% KMnO<sub>4</sub> a little at a time. It was reduced at once and gave the odor of PhNO and then that of PhNO<sub>2</sub>. In all 850 cc. were used. On filtering off the MnO<sub>2</sub> a liquid was obtained, the cause of the color of which is unknown, but it may be due to yellow NO<sub>2</sub>C<sub>6</sub>H<sub>4</sub>OH formed according to the equation: A + O<sub>2</sub> → PhNO + NO<sub>2</sub>C<sub>6</sub>H<sub>4</sub>OH, or to a diazo deriv. formed in a successive phase. The soln. did not give a color with  $\beta$ -naphthol nor with PhNMe<sub>2</sub>; the color appeared only after acidifying the liquid which shows that an isodiazotate is formed. Further examn. showed the presence of isodiazobenzene showing that the oxidation gave PhN<sub>2</sub>OH but intermediates such as PhNO:NCO<sub>2</sub>H, PhNO:NCOCO<sub>2</sub>H, could not be found. On treating B similarly with KMnO<sub>4</sub> it was found to be resistant but on standing overnight the KMnO<sub>4</sub> was reduced and the soln. was filtered. B is difficult to free from A and this reaction constitutes a good test for its purity. B can also be sepd. by adding 2% KMnO<sub>4</sub> until the color is permanent, filtering and on adding dil. H<sub>2</sub>SO<sub>4</sub> B is sepd. nearly pure. This difference in behavior resembles the difference previously found in the action of halogen and HNO<sub>3</sub> on PhN(:O):NC<sub>6</sub>H<sub>4</sub>Br and PhN:N(:O):C<sub>6</sub>H<sub>4</sub>Br of which the 1st is indif-

ferent but of which the 2nd easily undergoes substitution in the Ph group. Similarly of the *o*-azoxyphenols  $\text{PhNO}:\text{NC}_6\text{H}_4\text{OH}$ , m.  $76^\circ$ , and  $\text{PhN}:\text{NO}:\text{C}_6\text{H}_4\text{OH}$ , m.  $108^\circ$ , the 1st is most easily oxidized. *p*,*p*-Azoxyphenol (C),  $\text{HOC}_6\text{H}_4\text{NO}:\text{NC}_6\text{H}_4\text{OH}$  was prepd. from the azophenol with  $\text{H}_2\text{O}_2$ . 4 g. C as above with 2%  $\text{KMnO}_4$  became permanently colored with 1400 cc. The filtrate was brown-yellow and gave no color with  $\beta$ -naphthol. No diazo compds. were formed but much  $(\text{CO}_2\text{H})_2$  was present. No evidence of the presence of  $\text{N}_2\text{O}(\text{CO}_2\text{H})_2$  derived from  $\text{N}_2(\text{CO}_2\text{H})_2$  could be obtained. Adding 2%  $\text{KMnO}_4$  to an alk. soln. of *p*-azophenol caused gas to be evolved as in the above and gave the odor of  $\text{PhNO}$ . Another portion of 2 g. was oxidized in an ice bath with 420 cc.  $\text{KMnO}_4$ . When the soln. was filtered and treated with  $\beta$ -naphthol it gave a small amt. of benzenazonaphthol. This shows that some isodiazotate was formed and that some of the azoxy compd. A or B is also formed in this case and renders the following reaction scheme probable:  $\text{Ph}(\text{N}_2\text{O})\text{C}_6\text{H}_4\text{OH} \rightarrow \text{Ph}(\text{N}_2\text{O})\text{CO}_2\text{H} \rightarrow \text{PhN}:\text{NOH}$ . These transformations show the relationship between aromatic azoxy derivs. and the diazo compds. The azoxycarboxamide,  $\text{PhN}(:\text{N}):\text{NCONH}_2$ , represents the breakdown of other similarly substituted derivs. as A. has previously shown. This compd. then undergoes decompn. by the action of alkali with the loss of  $\text{NH}_3$ , giving  $\text{PhN}(:\text{O})\text{NCO}_2\text{H}$  and the soln. gives a strong diazo reaction. A. discusses his reasons for considering the isomeric diazo compds. to be  $\text{PhN}(:\text{O})\text{NH}$  and  $\text{PhN}:\text{NOH}$  instead of some of the other formulas that have been proposed. E. J. WITZEMANN

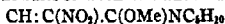
*p*-Isonitrileazobenzene. M. PASSERINI. R. Ist. di Studi Sup., Florence. *Gazz. chim. ital.* 50, II, 340-4 (1920).—*p*-Aminoazobenzene (A) like other primary amines undergoes the Hofmann reaction thus:  $\text{PhN}:\text{NC}_6\text{H}_4\text{NH}_2 + \text{CHCl}_3 + 3\text{NaOH} \rightarrow 3\text{NaCl} + 3\text{H}_2\text{O} + \text{PhN}:\text{NC}_6\text{H}_4\text{N}:\text{C}$ , giving the corresponding carbylamine, *p*-isonitrileazobenzene (B). B is notable for its stability among compds. of this class and for the high yield obtained even in only 80% EtOH. To 10 g. A in a little EtOH were added 22 cc.  $\text{CHCl}_3$ . The mixt. was heated on a boiling  $\text{H}_2\text{O}$  bath with 11.5 g. NaOH in 80% EtOH for about 1.5 hrs. Most of the EtOH was evapd.,  $\text{H}_2\text{O}$  was added to dissolve the NaCl and to ppt. a yellow compd. which was dried and dissolved in petr. ether but left a dark red residue of a secondary product. B thus obtained in soln. was recrystd. several times; yellow needles, m.  $110^\circ$  (brown  $106^\circ$ ). Boiled with inorg. acids B like other carbylamines gives CO and A. Boiled with concd. AcOH B gives *p*- $\text{PhN}:\text{NC}_6\text{H}_4\text{NHAc}$ , m.  $144-6^\circ$ . With concd. aq.  $(\text{CO}_2\text{H})_2$  B gives formyl-*p*-aminoazobenzene, yellow scales, m.  $162^\circ$ . Oxidation of B with yellow  $\text{HgO}$  in dry  $\text{Et}_2\text{O}$  gives a mixt. from which *p*-azobenzene isocyanate (C) could not be sepd. (Gautier, *Ann. Chim.* [4] 17, 203 (1869)). Its formation was detd. indirectly by working in moist  $\text{Et}_2\text{O}$  in which  $\text{CO}_2$  was evolved. The amorphous residue on evapn. after extrn. with  $\text{C}_6\text{H}_6$  gives an insol. residue which was crystd. from  $\text{Me}_2\text{CO}$ , giving yellow scales of 4,4'-carbamidoazobenzene, m.  $270^\circ$  (decompn.), obtained in this case by the action of  $\text{H}_2\text{O}$  on C. With peracetic acid ( $\text{HOAc} + \text{H}_2\text{O}_2$ ) dild. with  $\text{Me}_2\text{CO}$  B gives in 7-8 days a group of products. On adding  $\text{H}_2\text{O}$  an orange-yellow product was obtained which on fractional crystn. from  $\text{Et}_2\text{O}$  gave yellow scales, m.  $270-80^\circ$  and orange-yellow prisms, m.  $195-8^\circ$ . The  $\text{Et}_2\text{O}$  mother liquors gave other yellow tablets, m.  $147-8^\circ$ .

E. J. WITZEMANN.

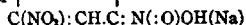
Aromatic nitro derivatives. XII. Action of *asym*-methylphenylhydrazine on  $\beta$ - and  $\gamma$ -trinitrotoluene. M. GIUA. Univ. Sassari. *Gazz. chim. ital.* 50, II, 327-30 (1920).—In continuing his study of the behavior of aromatic  $\text{NO}_2$  compds. containing a labile  $\text{NO}_2$  group (C. A. 9, 2089; 13, 841; 14, 1530, 1531, 1532), G. has treated  $\text{PhNMeNH}_2$  with  $\beta$ - and  $\gamma$ - $\text{MeC}_6\text{H}_3(\text{NO}_2)_3$ , which Will (C. A. 8, 1590) says contain an easily substitutable  $\text{NO}_2$  meta to the Me group. These reactions gave the substituted orange-red hydrazo compds., which are more stable than the corresponding hydrazo compds. that decomp. during fusion, while these do not decomp. at the m. p.  $2.27$  g.  $\beta$ - $\text{MeC}_6\text{H}_3$ -

(NO<sub>2</sub>)<sub>2</sub> in 20 cc. abs. MeOH treated with 1.89 g. PhNMeNH<sub>2</sub> becomes bright green and then brown and seps. a red-brown mass of *5-methyl-2,6-dinitromethylhydrazobenzene*, orange-red prisms from EtOH, m. 147°, gives a green color with alkalis.  $\gamma$ -MeC<sub>6</sub>H<sub>3</sub>(NO<sub>2</sub>)<sub>2</sub> treated similarly gives *5-methyl-2,4-dinitromethylhydrazobenzene*, orange-red prisms, m. 141°. As an appendix to paper XI of this series G. discusses the work of Borsche and Fiedler (C. A. 7, 3325) in which they describe a methylnitrobenzazimidole which is apparently not identical with that which G. believes he obtained by the action of NH<sub>2</sub>NH<sub>2</sub> on 2,3,4-(O<sub>2</sub>N)<sub>3</sub>C<sub>6</sub>H<sub>2</sub>Me. E. J. WITZEMANN

**Molecular organic compounds. V. Addition compounds and the process of substitution in the benzene ring.** M. GIUA, A. MARCELLINO AND A. CURTI. Univ. Sassari. *Gazz. chim. ital.* 50, II, 300-12(1920); cf. C. A. 15, 520.—A widely considered theory for the interpretation of many org. reactions is that intermediate products of addition are formed. It is for this reason that the isolation of such intermediate compds. is important. *sym*-Trinitroanisole either in EtOH soln. or by direct addition of the components with piperidine gives a stable mol. compd. that can be sepd. Moreover the same compds. give rise to picrylpiperidine (A) by condensing with the elimination of MeOH. A has also been obtained from picryl chloride + C<sub>6</sub>H<sub>11</sub>N in the presence of K<sub>2</sub>CO<sub>3</sub> in Et<sub>2</sub>O soln. *sym*-Trinitroanisole + C<sub>6</sub>H<sub>11</sub>N in EtOH with Na<sub>2</sub>CO<sub>3</sub> also gives A. The formation of A may then be considered to proceed in 2 steps: (1) the formation of the addition product; (2) the breaking up of this compd. and the substitution of the piperidine group for the OMe. This reaction has led to the study of others to see if they also give addition compds. [Cf. Guye, *J. chim. phys.* 8, 189 (1910) and C. A. 4, 2395 and Schmidlin, C. A. 5, 487; 6, 2428.] On the basis of work of Sudborough



and Picton (*J. Chem. Soc.* 89, 583(1906)) G., *et al.*, consider



as the formula of the addition compd. and that since the formation of A from this compd. is favored by alkali this occurs by first forming the Na salt. 6.3 g. (1 mol.) trinitroanisole treated slowly with 4.35 g. (2 mols.) C<sub>6</sub>H<sub>11</sub>N reacted with evolution of heat and on cooling solidified. Recrystd. from EtOH, the addition compd. seps. as yellow prismatic needles that begin to decomp. 281°. The same product was obtained in EtOH soln. and even long boiling did not convert it into A. On adding Na<sub>2</sub>CO<sub>3</sub> to the EtOH soln. A was pptd.; orange-yellow prisms from EtOH, m. 106.5°. In order to det. if similar results are obtained in other cases the formation of NO<sub>2</sub> derivs. of Ph<sub>2</sub>NH was studied. For this purpose G., *et al.*, have studied the binary systems of 2,4-(O<sub>2</sub>N)<sub>2</sub>C<sub>6</sub>H<sub>3</sub>Cl (B) with *o*- and *m*-O<sub>2</sub>NC<sub>6</sub>H<sub>4</sub>NH<sub>2</sub>,  $\alpha$ -C<sub>10</sub>H<sub>7</sub>NH<sub>2</sub> and *p*-H<sub>2</sub>NC<sub>6</sub>H<sub>4</sub>COMe. In these systems except that with *m*-O<sub>2</sub>NC<sub>6</sub>H<sub>4</sub>NH<sub>2</sub> the addition compds. are formed which are considered to be the 1st stage of the reaction that gives rise to the Ph<sub>2</sub>NH derivs. G., *et al.*, also studied the 2nd stage of the reaction from which it was found that these derivs. may be prepd. in this more bland way. For instance 2,4,3'-trinitrodiphenylamine was previously obtained from *m*-O<sub>2</sub>NC<sub>6</sub>H<sub>4</sub>NH<sub>2</sub> with ClC<sub>6</sub>H<sub>4</sub>NO<sub>2</sub> and MgO at 200° in the sealed tube, while here it was obtained by heating the 2 compds. to 185° in an oil bath. The results confirm the idea that even in processes of substitution in the C<sub>6</sub>H<sub>5</sub> ring the reaction may be accompanied by the formation of intermediate addition compds. One exception was observed of which the Ph<sub>2</sub>NH deriv. was prepd. as stated. B with *o*-O<sub>2</sub>NC<sub>6</sub>H<sub>4</sub>NH<sub>2</sub> (C) gives the addition compd. that m. = 35° and the eutectic between B and this compd. is at 31° and 22% C. The eutectic between C and the compd. is 33.5° at 45% B. B with *m*-O<sub>2</sub>NC<sub>6</sub>H<sub>4</sub>NH<sub>2</sub> (D) shows only 1 eutectic at 34.3° and 52% D and an addition compd. is formed. B with  $\alpha$ -C<sub>10</sub>H<sub>7</sub>NH<sub>2</sub> (E) gives an addition compd. that m. 71.5° and gives a eutectic with B at 38° and 12% E while its eutectic with E lies at 34° and 23% E. B with *p*-H<sub>2</sub>NC<sub>6</sub>H<sub>4</sub>COMe (F) gives an addition compd. (1 B to 2 F) with 57.14 g. F and the entire curve could not be detd.

While making the f.-p. detns. some red-yellow needles of 2,4-dinitro-4'-acetyldiphenylamine (G) were formed, m. 185°. Derivs. of G will be reported later. E. J. W.

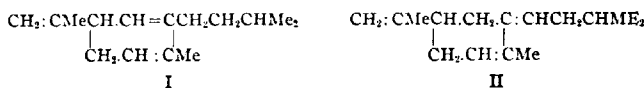
Some derivatives of peonol. ADOLF SONN. Univ. Königsberg i. Pr. *Ber.* 54B, 358-60(1921); cf. Rennie, Cooke and Finlayson, *C. A.* 14, 2617; Adams, *C. A.* 13, 1850.—2-Methoxy-4-hydroxy-5-acetoazobenzene (benzeneazopeonol), from 3 g. peonol in excess of very dil. NaOH treated with the diazonium soln. from 1.85 g. PhNH<sub>2</sub>, brown-red needles from alc., m. 135°; 50 g. under 300 cc. alc. treated with 7.4 g. NaOH in H<sub>2</sub>O, then, with shaking and warming, with 200 g. Na<sub>2</sub>S<sub>2</sub>O<sub>4</sub>, filtered hot and freed from the PhNH<sub>2</sub> and alc. with steam gives 22.5 g. 3-aminopeonol, yellowish needles, m. 115°, gives in H<sub>2</sub>O with FeCl<sub>3</sub> a deep wine-red color and on addition of more FeCl<sub>3</sub> violet flocks; diacetyl derivative, microcolumns, m. 165°. 3-Nitro-4-methoxy-6-hydroxyphenyl 4'-methoxystyryl ketone, from 2 g. 3-nitropeonol in 8 cc. KOH (4 cc. of 33% KOH and 4 cc. H<sub>2</sub>O) allowed to stand some days with 1.3 g. anisaldehyde, taken up in H<sub>2</sub>O, acidified, rubbed with NaHCO<sub>3</sub>, filtered and crystd. from AcOH, slender yellow leaflets, m. 182°, gives a deep orange-red color with alc. FeCl<sub>3</sub>, reduced by Sn in AcOH-HCl to the NH<sub>2</sub> compd. whose acetyl derivative, needles from AcOH, m. 203°. C. A. R.

The preparation of diiodosalicylic acid and its solubility in water. VICTOR COFMAN. *Gazz. chim. ital.* 50, II, 296-99(1920).—The processes used heretofore in the prepn. of diiodosalicylic acid (A) gave a mixt. of products among which were monoiodosalicylic acid (B), various diiodophenols and sometimes the "red compd." of Lauteman (*Ann.* 120, 299(1861)). Since A is used in medicine and somewhat in the color industry an easy method of prepg. pure A is useful. Such a method is here described. 14 g. salicylic acid in glacial AcOH were mixed with 18 g. ICl in 50 cc. AcOH and then 400 cc. H<sub>2</sub>O were added. From this soln. A seps. colored more or less red with ICl. The ppt. is filtered and dried for some hrs. at 100° and A becomes white and is crystd. from boiling AcOH; colorless odorless needles, darken 220°, m. 228-30° (decompn.). According to the accepted opinion A is 3,5,2-I<sub>3</sub>(HO)C<sub>6</sub>H<sub>2</sub>CO<sub>2</sub>H. The iodation is supposed to be accomplished by IOH formed thus: ICl + H<sub>2</sub>O → IOH + HCl. An excess of A in 250 cc. H<sub>2</sub>O was kept at const. temp. with frequent agitation for several days. The soly. was detd. by titrating A with standardized NaOH. A is sol. 1: 6000 at 10° and 1: 5200 at 25°. Liechti obtained higher values, probably due to the presence of B which is more sol. in H<sub>2</sub>O. E. J. WITZEMANN

Preparation of 3,4-dihydroxyphenylalanine. YOSHIO SUGI. *J. Pharm. Soc. Japan* 46B, 130-6(1921).—The ordinary Erlenmeyer method of NH<sub>2</sub> acid synthesis could not be applied to the prepn. of dopa, or 3,4-dihydroxyphenylalanine. An attempt to obtain 3,4-dihydroxy- $\alpha$ -benzoylaminocinnamic acid by breaking the azolactone formed by heating protocatechualdehyde with hippuric acid was not successful. By substituting vanillin for the aldehyde, S. prepd. it without any difficulty. 3 g. each of vanillin and hippuric acid are mixed with 6 g. of anhydrous NaOAc and 15 cc. of Ac<sub>2</sub>O and heated on a steam bath under a reflux condenser. 4.1 g. of the azolactone, C<sub>15</sub>H<sub>11</sub>O<sub>4</sub>N, m. 185°, is obtained. 1 g. of this azolactone is dissolved in 100 cc. of hot 10% NaOH, and treated with 5% H<sub>2</sub>SO<sub>4</sub> till it changes Congo red paper to blue. On standing, about 0.7 g. of *p*-hydroxy-*m*-methoxy- $\alpha$ -benzoylaminocinnamic acid, m. 205°, was obtained in cryst. form and was reduced by Na-Hg to *p*-hydroxy-*m*-methoxy- $\alpha$ -benzoylaminohydrocinnamic acid, m. 157°. The Bz and Me groups are then split off by heating it with 3% HCl in sealed tubes at 150° for 8 hrs. By filtration and extn. with ether, the last trace of BzOH is removed. The filtrate is concd. under reduced pressure and extd. with abs. alc.; on adding NH<sub>4</sub>OH, dopa crystals out; it changes to brown in alk. soln., but is stable in HCl. S. T.

Gum ammoniac oil and synthetic experiments for the determination of its constituents. PAUL ROEHNISCH. *Diss. Schlesische Friedrich-Wilhelms-Universität, Breslau* 1916,

69 pp.—No. sepn. into individual constituents was possible by means of fractional distn. and the fractions obtained showed only very small differences in their phys. constns. Therefore, the synthesis and characterization of aliphatic and monocyclic sesquiterpene substances were conducted for purposes of comparison with those contained in the oil. The results were: (1) A synthetic monocyclic sesquiterpene, *isoamyl- $\alpha$ -dehydraphellandrene* (I or II) (probably I), from iso-AmI and carvone by Grignard's reaction,  $b_{11}$  130–2°,  $d_{20}$  0.8679,  $n_D^{20}$  1.49478,  $\alpha_D^{20}$  18°30', is not reduced by Na and EtOH and but partly by Na and AmOH. Reduction by H and Pt black gives the completely reduced monocyclic hexahydrosesquiterpene *tetrahydraphellandrene*,  $C_{15}H_{26}$ ,  $b_{11}$  131–3°,  $n_D^{23}$  1.45562,  $d_{22}$  0.8250,  $\alpha_D^{22}$  –1°30'. Unlike zingiberene, treatment with HCl does not give a solid addition product. (2) A monocyclic sesquiterpene ketone, *isoamylidihydrocarvone*,  $C_{15}H_{26}O$ ,  $b_{10}$  144–9°,  $d_{20}$  0.9022,  $n_D^{20}$  1.47694,  $\alpha_D^{20}$  –8°, 0.8993,  $n_D^{20}$  1.47449,  $\alpha_D^{20}$  –1°. Reduction of this alc. gave the monocyclic alc.,  $C_{15}H_{26}O$ ,  $b_{10}$  150–5°,  $d_{20}$  0.8993,  $n_D^{20}$  1.47449,  $\alpha_D^{20}$  –1°. Reduction of this alc. with Pt and H gave the satd. monocyclic alc.,  $C_{15}H_{28}O$ ,  $b_{12}$  145–52°,  $d_{20}$  0.8906,  $n_D^{20}$  1.46855,  $\alpha_D^{20}$  –1°. (3) A monocyclic sesquiterpene alc., *isoamylidihydrocarveol*,  $C_{15}H_{26}O$ ,  $b_{12}$  155–70°,  $d_{20}$  0.9217,  $n_D^{20}$  1.4917,  $\alpha_D^{20}$  –1°. (2) and (3) are contained in small quantities in a higher boiling fraction from the



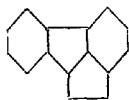
Grignard reaction. These expts. showed that in all probability no O-containing substances of the monocyclic series of sesquiterpenes are present in gum ammoniac oil since the completely satd. synthetic alc.,  $C_{15}H_{26}O$ , already has a d. of 0.89 while a fraction from the oil having the same b. p. showed a d. of only 0.875. Also the alc. contained 13.27% H against the 12.20% H in this fraction. The analysis, low d. and small refractive index all indicate that the oil must consist essentially of aliphatic substances. The first completely hydrogenated aliphatic sesquiterpene alcohol was produced, *hexahydrofarnesol*,  $C_{15}H_{28}O$ . This was accomplished in the usual manner with Pt and H acting upon the alc., farnesol. The new compd.  $b_{13}$  145–55°,  $d_{22}$  0.8387,  $n_D^{22}$  1.44525,  $\alpha_D^{22}$  0°. The following substances were identified in the fractions distd. from the oil: (1) Linalyl acetate which was sapond. to linalool, identified through its phenylurethan m. 65° and by its oxidation to citral; (2) A terpene acetate,  $C_{15}H_{24}O_2$  (citronellyl acetate?), yielding on sapon. the terpene alc.,  $C_{15}H_{24}O$ , which may be assumed to be citronellol because of its oxidation product, citronellal. (3) A hydrogenated monocyclic sesquiterpene, *ferulene*,  $C_{15}H_{26}$ ,  $b_7$  124–26°,  $d_{20}$  0.8698,  $n_D^{20}$  1.48423,  $\alpha_D^{20}$  6°. Reduction with Pt and H gave *tetrahydroferulene*,  $C_{15}H_{28}$ ,  $b_{10}$  118–22°,  $d_{20}$  0.8400,  $n_D^{20}$  1.45810,  $\alpha_D^{20}$  4.2°. (4) The first aliphatic sesquiterpene ketone ever obtained, *dorenone*,  $C_{15}H_{26}O$ ,  $b_{12}$  145–55°,  $d_{20}$  0.8765,  $n_D^{20}$  1.47160,  $\alpha_D^{20}$  3°30'. It forms a solid oxime,  $C_{15}H_{26}NOH$ ,  $b_{10}$  160–85°,  $d_{25}$  0.8970,  $n_D^{25}$  1.47889,  $\alpha_D^{25}$  +2°, m. 88°. It forms also a solid semicarbazone, m. 124°, and is reduced by Pt and H to *tetrahydrodorenone*,  $C_{15}H_{28}O$ , while reduction with Na and alc. yields an aliphatic sesquiterpene alc.,  $C_{15}H_{28}O$ , *doremol*, which in turn is reduced by Pt and H to *tetrahydrodoremol*,  $C_{15}H_{30}O$ . *Dorenone oxime acetate*  $b_1$  180–95°,  $d_{20}$  0.9283,  $n_D^{20}$  1.47370,  $\alpha_D^{20}$  1°. (5) An acetate of an aliphatic sesquiterpene alc., *doremyl acetate*,  $C_{17}H_{30}O_2$ , which on sapon. yields *doremol* which in turn on reduction yields *dihydrodoremol*,  $C_{15}H_{28}O$ , and *tetrahydrodoremol*. (6) A solid paraffin alc.,  $C_{16}H_{34}O$ , m. 48°, apparently identical with cetyl alc. A. R. M.

**Photochemical transformations in the triphenylmethane series and photoconcentration chains.** J. LIFSCHITZ AND CH. L. JOFFÉ. Univs. Zürich and Groningen. *Z. physik. Chem.* 97, 426–44 (1921); cf. *C. A.* 14, 1984.—The following substances were

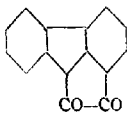
employed in the investigation: the leuco cyanides of *p*-rosaniline, crystal violet, Victoria blue, malachite green, brilliant green, and the carbinol bases of crystal violet—and of malachite green. Solns. of these substances in abs. alc. contained in a quartz flask were subjected to both light and darkness for varying lengths of time. The changes which took place were measured in the way previously described. It has been found that the photochem. changes which take place with the substances studied are reversible. The mechanism of these reactions is explained in the way given in the previous paper. It is pointed out that the detn. of the stationary photo-condition can be investigated in 2 ways: either spectral-photometrically or electrochemically. It has been found that ultraviolet light of long wave length is the most effective in bringing about the photochem. transformations. The different substances used in the investigation mostly dissolve in alc.,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ ,  $\text{CHCl}_3$  and in dil. and concd. mineral acids, in the absence of light, to form colorless solns. which gradually become colored on exposure to the light. The time required for the coloration varies with the solvent employed. Alc. solns. of the leuco cyanide of Victoria blue which remain practically colorless for hrs. at ordinary temp., in spite of intensive ultraviolet radiation, rapidly become colored at 35–40°. It is suggested that this behavior is due to the Victoria blue deriv. going over into a photosensitive compd. at higher temps. The reaction which takes place in the dark is easily catalyzed. Here the formation of mol. compds. undoubtedly plays a part. From the data obtained for cyanomethylquinidin, it is evident that in soln. a rearrangement to  $\text{NH}_2\text{CN}$  occurs spontaneously and that this proceeds to a characteristic equil. It is pointed out that the photochem. formation of dye derivs. in the light is to be regarded as analogous to the formation of triphenyl-ynes by the radiation of solns. of the corresponding triphenylmethanes and trichloromethanes; and that this affords additional support for the theory of dye chromophores earlier proposed. In conclusion, photo-concn. chains, which give very appreciable e.m.f., are described and discussed, e. g., on subjecting a non-conducting leuco cyanide soln. to radiation, a highly dissociated dye-cyanide is formed and a considerable CN ion concn. results. With the arrangement, electrode | radiated soln. | non-radiated soln. | electrode, an e.m.f. of approx. 0.2 v. can be obtained. H. JERMAIN CREIGHTON

**Constitution of fluoranthene.** (Synthesis of isodiphenic acid and of fluorenone-1-carboxylic acid.) FRITZ MAYER AND KARL FREITAG. Univ. Frankfurt a. M. *Ber.* **54B**, 347–57 (1921).—From the fact that fluoranthene (A) with  $\text{CrO}_3$  yields a fluoranthenequinone (B) and a fluorenecarboxylic acid (C) and that the latter can be converted into a diphenyldicarboxylic acid ("isodiphenic acid") (D) which can be degraded to  $m\text{-C}_6\text{H}_4(\text{CO}_2\text{H})_2$ , Fittig concluded (*Ann.* **200**, 1 (1880)) that D is diphenyl-2,3'-dicarboxylic acid and that A, B and C have the structures I, II and III, resp. Thus far, however, C and D had never been synthesized and compared with F.'s products and attempts to synthesize A had failed (*C. A.* **9**, 94). D has now been synthesized in 2 ways. 2,3'-Azotoluene,  $b_p$  183–6°, is obtained in 12% yield from 20 g. powdered NaOH and 20 g.  $m\text{-MeC}_6\text{H}_4\text{NH}_2$  treated in the course of 1.75 hrs. at 190–200° with 22 g.  $o\text{-O}_2\text{NC}_6\text{H}_4\text{Me}$ , and in 50–60% yield, starting from  $o\text{-MeC}_6\text{H}_4\text{NH}_2$ , from 4'-amino-2,3'-dimethylazobenzene deaminated in alc. with  $\text{EtONO}$ ; 0.2 mol. of the azotoluene in 80 g. warm alc. slowly treated with 100 g.  $\text{SnCl}_4$  in 140 cc. concd. HCl and 54 cc.  $\text{H}_2\text{O}$ , then heated 4 hrs. under a reflux on the  $\text{H}_2\text{O}$  bath, concd. somewhat to remove the alc., filtered after 12 hrs., dissolved in  $\text{H}_2\text{O}$ , made faintly alk. with NaOH, exhd. with  $\text{Et}_2\text{O}$ , washed with  $\text{H}_2\text{O}$  and dried with  $\text{Na}_2\text{SO}_4$  gave 60–5% of 4,4'-diamino-2,3'-dimethyldiphenyl (2,3'-tolidine),  $b_p$  243–6°, a yellow-brown oil quickly solidifying to an amorphous glassy mass, characterized as a primary diamine by the prepn. of a number of azomethines, viz., with benzaldehyde, m. 106–7°; salicylaldehyde, m. 160–1°; anisaldehyde, m. 142–3°; *p*-chlorobenzaldehyde, m. 149–50°; *o*-chlorobenzaldehyde, m. 102–3°; *p*-nitrobenzaldehyde, m. 195–6°. Dibenzoyl derivative, m. 245–6°. 4,4'-Tetraacetyldiamino derivative, obtained in 95% yield from the base

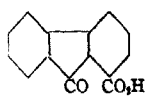
boiled 9 hrs. under a reflux with 9-10 parts  $\text{Ac}_2\text{O}$ , leaflets from alc., m.  $191-2^\circ$ . *4,4'-Diacetyldiamino compound*, from the base boiled 5 hrs. with 10 parts  $\text{AcOH}$  or from the tetra-Ac compd. boiled a short time with concd.  $\text{HCl}$ , tables from  $\text{PhNO}_2$ , m.  $253-4^\circ$ . The tolidine is converted through the tetrazo compd. by  $\text{SnCl}_4$  (Meyer and Lecco, *Ber.* 28, 2541(1895)) into *4,4'-dihydrazino-2,2'-dimethyldiphenyl hydrochloride*, yellowish needles from  $\text{H}_2\text{O}$  containing a little  $\text{HCl}$ ; the free *dihydrazine*, unstable yellowish white ppt. (obtained from 0.1 mol. of the tolidine) is at once mixed thoroughly with 66 g.  $\text{Cu}(\text{OAc})_2$  and distd. from a retort; the distillate is neutralized with  $\text{NaOH}$ , extd. with  $\text{Et}_2\text{O}$ , washed successively with dil.  $\text{NaOH}$ , dil.  $\text{H}_2\text{SO}_4$  and  $\text{H}_2\text{O}$ , dried over  $\text{NaOH}$ , evapd., dried with  $\text{Na}$  and fractionated, giving 30% *2,3'-ditolyl*, b.  $273-4^\circ$ ,  $d_{20}$  0.9984,  $n_D$  1.5848; 5 g. of this suspended in 200 cc. gently boiling  $\text{H}_2\text{O}$  and treated in the course of 18 hrs. with 19 g. of  $\text{KMnO}_4$  (2% soln.) yields 4.3 g. **D**, needles from dil.  $\text{AcOH}$ , m.  $215-6^\circ$ , identical with a sample prepd. by F.'s method from **A**. *Diamide*, from the chloride (prepd. with  $\text{PCl}_5$  on the  $\text{H}_2\text{O}$  bath) and concd.  $\text{NH}_4\text{OH}$ , rodlets from  $\text{H}_2\text{O}$  containing a little  $\text{NH}_4\text{OH}$ , m.  $182-3^\circ$ . *Dianilide*, from the chloride (prepd. with  $\text{SOCl}_2$  on the  $\text{H}_2\text{O}$  bath) and  $\text{PhNH}_2$  in  $\text{Et}_2\text{O}$ , rodlets from alc., m.  $219-20^\circ$ . **C**, identical with F.'s compd., is obtained in 12% yield from 2 g. **D** heated 5 min. at  $140-50^\circ$  with 5-10 cc. of concd.  $\text{H}_2\text{SO}_4$ ; it seps. from  $\text{PhMe}$  in long golden yellow to orange-red needles, m.  $192-4^\circ$ . For the second synthesis of **D** 16 g. each of *o*- and *m*- $\text{IC}_6\text{H}_4\text{Me}$  were heated 4 hrs. at  $230-40^\circ$  in a shaking furnace with 32 g. "Naturkupfer C;" in this way 56 g. of each of the  $\text{IC}_6\text{H}_4\text{Me}$  gave 38 g. oil which after repeated fractionation yielded 11.6 g. b.  $270-4^\circ$  and 6.3 g. b.  $274-80^\circ$ . Oxidation as above of 3 g. of each fraction with 12 g.  $\text{KMnO}_4$  yielded, resp., 1 g. of yellowish white acid, m. partially  $200-15^\circ$  but not completely even at  $250^\circ$ , and 1.2 g. of light yellow



I



II



III

acid behaving similarly on heating; on extg. 0.5 g. each of these products with  $\text{H}_2\text{O}$  there were obtained 0.25 and 0.15 g., resp., of pure **D**. CHAS. A. ROUILLER

**Electrolytic reactions of naphthalene and its derivatives. I. Electrolytic oxidation of naphthalene.** KAISRICHI ONO. *J. Chem. Soc. Japan* 42, 38-66(1921).—The effect of different anodes, nature of the electrolytes, density of current, temp. of electrolysis, quantities of current, mode of producing  $\text{O}_2$ , and catalyzers on elec. oxidation of  $\text{C}_{10}\text{H}_8$  were investigated. The conclusions are: only in an acid soln. does the oxidation proceed. In alk. medium (50 cc. 20%  $\text{NaOH}$ , 100  $\text{Me}_2\text{CO}$ , 3.8 g.  $\text{C}_{10}\text{H}_8$ , Pt electrodes) the reaction does not occur. As A. Panchaud de Botten showed a  $\text{Me}_2\text{CO}-\text{H}_2\text{SO}_4$  mixt. gives the best results in respect to both oxidative efficiency and grade of naphthoquinone. The optimum acidity is obtained by taking 20-30 cc. of  $\text{H}_2\text{SO}_4$  (d. 1.84) for each 100 cc.  $\text{H}_2\text{O}$ . Pt,  $\text{Pb}_2\text{O}$ , Ni, Pb, Fe were used, of which the electrodes made of  $\text{Pb}_2\text{O}$  and Pt are the best, probably due to efficiency in  $\text{O}_2$  evolution as well as their action as catalyzers. The current density goes parallel with oxidative efficiency but not with the yield of  $\alpha$ -naphthoquinone. With  $\text{Pb}_2\text{O}$  electrodes, 2 amp. per 100 square cm. is the best, and with Pt, 3 amp. With a rise of temp. the oxidation increases, but the yield of  $\alpha$ -naphthoquinone does not necessarily go parallel with it. With  $\text{Pb}_2\text{O}$  electrodes, the room temp. is the optimum; with Pt, the yield of the quinone increases proportionally with rise of temp. With an increase in the quantity of electricity the more  $\text{C}_{10}\text{H}_8$  is oxidized, but gives less quinone, due to further oxidation of the latter. Catalyzers are effective in the following order:  $\text{Ce}(\text{NO}_3)_6$ , vanadic acid.





blue fluorescence in EtOH. 14.8 g. piperonal  $\pm$  8.8 g.  $\text{AcCO}_2\text{Et}$  in 200 cc. EtOH and  $\beta\text{-C}_{10}\text{H}_7\text{NH}_2$  in 100 cc. EtOH treated as above gave  $\alpha$ -methylene-3,4-dioxypheyl- $\beta$ -naphthocinchoninic acid (F), m. 292°; the sodium salt, with 4.5  $\text{H}_2\text{O}$ , seps. as white needles; the methyl ester seps. as white scales, m. 170°. The reaction liquor treated as above gave *py-tetrahydro- $\alpha$ -3,4-methylenedioxyphenyl- $\beta$ -naphthocinchoninic acid* (G), as nearly colorless crystals, m. 233°. G oxidized as above with  $\text{KMnO}_4$  gave F. The portion insol. in  $\text{NH}_4\text{OH}$  was identified as *methylenedioxybenzyl- $\beta$ -naphthylamine*, reddish scales, m. 119°. The secondary products of the reaction of Doebner between  $\text{BzH}$ ,  $\beta\text{-C}_{10}\text{H}_7\text{NH}_2$  and  $\text{AcCO}_2\text{H}$  were isolated as in the 2 preceding cases. The white powder insol. in dil.  $\text{NH}_4\text{OH}$  was  $\alpha,\beta$ -dinaphthylidiaminodibenzyl, m. 167°, which as was stated above was thought to be formed by reduction of B. E. J. W.

**Pyrrole blacks.** VII. A. ANGELI and C. LUTRI. *Gazz. chim. ital.* **51**, I, 31-4 (1921); cf. C. A. **14**, 172, 2786.—The expts. described constitute a continuation of unnumbered previous communications on this subject designed to clarify the formation and structure of these products. A. and L. have now prepd. such a pyrrole black by the action of pyrrole on benzoquinone in the presence of  $\text{H}_2\text{O}$  which is probably formed by the union of the 2 residues by oxidation. Owing to its insoly. it has not been possible to det. whether the prepn. is composed of 1 compd. or a mixt. In selecting the solvent glacial AcOH, it was desired to avoid side reactions of the solvent with the reagents. To 4 g. quinone dissolved in 100 cc. warm glacial AcOH, 0.7 g. pyrrole was added. The soln. became violet at once and in an hr. began to sep. a black powder. The next day it was collected on a filter, washed with AcOH and then  $\text{H}_2\text{O}$  and dried. The analytical data for the black prepn. coincide with data previously obtained with a product from the same reagents in  $\text{H}_2\text{O}$ . As is known pyrrole gives highly colored black products by the action of  $\text{HNO}_2$  in which case nitrosopyrrole is probably first formed which cannot be obtained in the free state. It was found previously that the true NO compds. react slowly on pyrrole and indole but rapidly in the presence of KOEt but not to give blacks. When AcOH is used, however, a black compd. is obtained. 1 g. pyrrole + 2 g. *p*-ONCH<sub>3</sub>OH in 50 cc. glacial AcOH showed a black ppt. the next day which was filtered off after a week. The black powder was sol. in alkalis and gave a compn. of about  $\text{C}_{22}\text{H}_{22}\text{N}_4\text{O}_2$  on analysis. *p*-Quinoneimine and *p*-quinonedimine gave similar products with pyrrole which will be studied further. E. J. WITZEMANN

The preparation and properties of 1,3,5-trinitrobenzene (RADCLIFFE, POLLITT) **24**. The electrolytic manufacture of *p*-aminophenol (MCDANIEL, *et al.*) **4**. Preparation of platinum sponge (FEULGEN) **2**.

HENLE, FRANZ WILHELM: **Anleitung für das organisch-chemische Praktikum.** 2nd Ed. revized. Preface by J. Thiele. Leipzig: Akad. Verlagsgesellschaft. m. b. H. M. 30. For review see *Z. öffentl. Chem.* **27**, 84 (1921).

**Oxalates; oxalic acid.** OLDBURY ELECTRO-CHEMICAL CO. Brit. 160,747, Oct. 6, 1920. A mixt. of Na oxalate,  $\text{Ca}(\text{OH})_2$ , and  $\text{H}_2\text{O}$  is agitated in a closed vessel and treated with  $\text{CO}$ , or gases containing  $\text{CO}$ , preferably under pressure and at temps. above 100°; the Ca oxalate is sepd. from the soln. of Na formate produced and the latter evapd. and converted by heat into Na oxalate for use in the first stage of the process. Reference is made also to the use of alkali oxalates and alk. earth hydroxides in general.  $(\text{HOCO})_2$  is obtained by treating the Ca oxalate with  $\text{H}_2\text{SO}_4$ . In the conversion of Na formate to oxalate, the former may be first melted at 270° and then run into a decompn. vessel preheated to 440°; agents for increasing the yield are added if desired. In order to economize lime and  $\text{H}_2\text{SO}_4$  the Na oxalate may be first freed from  $\text{Na}_2\text{CO}_3$  by any known means, *e. g.*, by washing with  $\text{H}_2\text{O}$ ; the soln. of  $\text{Na}_2\text{CO}_3$  so

obtained may be treated with lime to give NaOH for the production of further formate and oxalate.

**Anthraquinone derivatives.** FARBERWERKE VORM. MEISTER, LUCIUS AND BRÜNING. Brit. 160,433, July 8, 1920. Addition to 147,001 (C.A. 14, 3675). The process described in the principal patent is effected in the absence of air, whereby products of greater purity are obtained; according to an example 1-nitro-2-methylantraquinone is treated with fuming  $\text{H}_2\text{SO}_4$  in an atm. of  $\text{CO}_2$ .

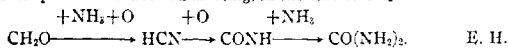
## 11—BIOLOGICAL CHEMISTRY

HATTIE L. HEFT, EDGAR G. MILLER, JR., AND WILLIAM J. GIES

### A—GENERAL

FRANK P. UNDERHILL

**Researches on the mechanism of the formation of urea.** R. FOSSE. *Bull. soc. chim. biol.* 2, 4-12(1920); *Physiol. Abstracts* 5, 138.—An intermediate substance, which gives rise to urea, is formed during the oxidation of proteins and amino acids. It may also be formed by the oxidation of many other substances, such as glycerol, carbohydrates, and  $\text{CH}_2\text{O}$ , in the presence of  $\text{NH}_3$ . The intermediate substance is believed to be  $\text{HCNO}$ , and the process is conceived as being, in the case of  $\text{CH}_2\text{O}$ :



**The diastase of the gastric juice of *Potamobius astacus*.** L. C. LOWARTZ. *Fermentforschung* 3, 241-310(1920); *Physiol. Abstracts* 5, 221.—A detailed account of expts. on the digestion of starch by the diastase of the gastric juice of the crayfish. The influence of salts, of the degree of diln., and of temp. on the activity of the gastric juice was investigated. The conclusion is drawn that the effects observed are all due to the presence of a single amylolytic enzyme. E. H.

**The gastric and respiratory response to meals.** T. I. BENNETT AND E. C. DODDS. Bland-Sutton Inst. of Path., London. *Brit. J. Exptl. Pathol.* 2, 58-65(1921).—Studied by means of gastric analysis and by estn. of alveolar  $\text{CO}_2$  tension normal men are found to fall into 4 distinct classes. The results obtained by the 2 methods are found to confirm one another. Cases showing achlorhydria during gastric analysis show a curve of alveolar  $\text{CO}_2$  tension similar to that obtained in patients following gastrectomy. Such cases show a fall in alveolar  $\text{CO}_2$  tension at a later period, indicating normal secretion during the later processes in digestion. Cases of hyperchlorhydria in healthy men have sometimes been found to show changes in alveolar  $\text{CO}_2$  tension following meals which exceed what have previously been considered physiol. limits. Some normal cases occur in which the processes of upper alimentary digestion are so rapid as to be only demonstrable by observations taken at very short intervals. Cases which yield a high gastric acidity during digestion are usually found to show a relatively high tension of alveolar  $\text{CO}_2$  even during the "resting" phases of the stomach; in cases of achlorhydria the reverse is seen. HARRIET F. HOLMES

**The influence of bile salts upon gastric function.** C. A. PANNETT AND C. M. WILSON. St. Mary's Hospital, London. *Brit. J. Exptl. Pathol.* 2, 70-4(1921).—It is shown experimentally in cats and man that the addition of a small quantity of Na taurocholate to a test-meal is followed by an abnormally rapid evacuation of the stomach contents. HARRIET F. HOLMES

**The union of the iron in the prosthetic group of the blood pigment.** W. KCSTER. *Z. physiol. Chem.* 110, 93-122(1920).—See C. A. 14, 3084. H. G.

**Relationships between the peptidolytic activity of intestinal erepsin and the chemical constitution of the substrate.** A. CLEMENTI. *Atti accad. Lincei* 29, ii, 327-9(1920).—

By means of the method of  $\text{CH}_2\text{O}$  titration C. has investigated the action of intestinal erepsin from the dog or pig on cholyglycine, benzoylglycine, bromoisohexoylglycine, and glycine anhydride. It is found that neither benzoylglycine, which normally is not present in the intestinal tube, nor cholyglycine, which normally passes with the bile from the liver into the intestine, is hydrolyzed by the intestinal erepsin, and that bromoisohexoylglycine, unlike leucylglycine, is also unattacked. In the case of glycine anhydride solns., a slight increase in the aminic N is apparently caused by the intestinal erepsin, but this is regarded as due to the scission of glycyglycine previously formed rather than to the formation of a fresh quantity of glycyglycine; the conclusion is hence drawn that the erepsin is not capable of detg. the rapid opening of the diketopiperazine ring of glycine anhydride. These results, in conjunction with the behavior of guanidylglycyglycine, show that suppression or absence or partial substitution of the free aminic group of the mol. of a polypeptide or similar compound may result in marked resistance of the  $\text{CO.NH}$  group to the hydrolyzing action of erepsin. J. C. S.

**Serecin and the estimation of its constituents.** WALTER TÜRK. *Z. physiol. Chem.* 111, 69-75(1920).—Silk was treated with water at  $145^\circ$  for 3 hrs. under a pressure of 3 atm., when serecin went into soln., and was pptd. from it with abs. alc. It was examd. for the various color reactions. The silk gelatin was then hydrolyzed with  $\text{H}_2\text{SO}_4$ , and the amts. of the amino acids obtained were: tyrosine 5.69%, leucine 1.79%, serine 6.81%, arginine 4.56%, lysine 1.69%, histidine 1.02%. J. C. S.

**The mechanism of the formation of methemoglobin through acetanilide and its derivatives.** PHILIPP ELLINGER. *Z. physiol. Chem.* 111, 88-125(1920).—From various expts. with acetanilide and some of its derivs. *in vivo* and *in vitro*, it is considered highly probable that the formation of methemoglobin from hemoglobin by the action of acetanilide depends on the intermediate formation of acetylphenylhydroxylamine from the acetanilide by contact with animal tissue. This, like all hydroxylamines, acts as a strong methemoglobin builder. Similarly, aceto-*o*-toluidide and phenacetin also act as methemoglobin builders indirectly. J. C. S.

**Radioactivity and normal physiological function.** V. H. BLACKMAN. *Ann. Botany* 34, 299-302(1920).—A review. Cf. Zwaardemaker, *C. A.* 14, 2497. T. G. PHILLIPS

**Observations on some physical properties of protoplasm by aid of microdissection.** WILLIAM SEIFRIZ. Johns Hopkins Univ. *Ann. Botany* 35, 269-98(1921).—Studies were made of a variety of material including myxomycetes, algae, molds, pollen tubes, protozoa and certain ova. (1) *Protoplasmic membranes.* The direct evidence from microdissection, supported by the indirect evidence derived from a consideration of surface phenomena, indicates the presence of a plasma membrane on the surface of all protoplasm. The membrane is essentially protoplasm differentiated at least in part by surface forces. It is commonly of high viscosity, probably a gel, but readily reverts to the sol state. It seems rather sharply delimited from the inner plasm but, in the living cell, is not capable of isolation. The nucleus and vacuoles also possess protoplasmic membranes quite similar to the outer plasma membrane. The thickness of the plasma membrane is probably about  $0.1\mu$ . (2) *The nonmiscibility of protoplasm in water.* When subjected to dissection in water, in by far the greater number of instances, protoplasm is immiscible in the surrounding medium. Occasional instances of miscibility may be ascribed to extreme liquidity or to disorganization (death). T. G. PHILLIPS

**Protoplasmic streaming caused by an ordered heat movement of molecules.** ARTHUR MEYER. *Ber. botan. Ges.* 38, 36-43(1920).—The curve showing the relation between the viscosity of castor oil and temp. is of the same form as that relating to the rate of protoplasmic streaming and temp. M. considers this as supporting his view that protoplasmic streaming is caused by a unidirectional mol. movement. T. G. PHILLIPS

**Does chloropicrin act upon the soluble enzymes?** G. BERTRAND AND MME. ROSEN-

BLATT. *Compt. rend.* 171, 137-9(1920); cf. *C. A.* 6, 1756; 7, 103, 1726, 1884, 3135.—In the expts. the chloropicrin was washed with slightly alk. water until neutral to methyl orange, then with pure water. Each of the following tests was made in parallel to det. the action of the enzyme in the absence and in the presence of a nearly satd. soln. of chloropicrin (about 1.7 g. per liter): Sucrose hydrolyzed in 24 hrs. at 28° by a sucrase from yeast, and by a sucrase from *Aspergillus niger*; HCN evolved in 24 hrs. at 33° from amygdalin by emulsin; NH<sub>3</sub> evolved in 30 min. at 35° from urea by urease from *Soja hispida*; O evolved in 30 min. at lab. temp. from H<sub>2</sub>O<sub>2</sub> by a catalase from calf liver and by a catalase from pig fat; sucrose decompd. by a zymase in 24 hrs. at 17.5°; also tests with a laccase and a tyrosinase. All results showed that chloropicrin has only a slight inhibiting action upon the sol. enzymes, the most marked being on urease. The toxicity of chloropicrin to living cells must be explained on other grounds. L. W. RIGGS

**Mechanism of an enzyme action as exemplified by pepsin digestion.** JOHN H. NORTHRUP. *Science* 53, 391-3(1921); cf. *C. A.* 14, 2346, 2647; 15, 540.—This paper records "an attempt to show that the peculiarities of a typical enzyme action, pepsin digestion, may be explained by the accepted laws of chem. reactions and that the apparent divergencies from these laws are due to the fact that the enzyme as well as the protein with which it reacts exists in soln. as equil. mixts., consisting, in the case of the protein of ionized and non-ionized protein, and in the case of the pepsin, of free and combined pepsin. The influence of the various factors on the digestion are primarily due to changes in these equilibria." The statements in the following summary are supported by exptl. evidence: The final amt. of change caused by the enzyme is independent of the amt. of enzyme present. The rate of change may or may not be proportional to the concn. of enzyme present. The rate of change is proportional to the concn. of the substrate in dil. soln. but increases less rapidly than the substrate concn. in solns. of higher concn. The amt. of substrate decompd. in the same time interval by varying enzyme concns. is not always proportional to the concn. of enzyme but is often proportional to the square root of this quantity (Schutz's rule). The reaction proceeds most rapidly at a certain definite H-ion concn. It has been found in a study of pepsin digestion that the above peculiarities may be quantitatively accounted for on the basis of the following mechanism: The protein reacts with the acid of the soln. to form an ionized protein salt. The amt. of this salt formed is detd. by the H-ion concn. of the soln. according to the well known laws governing the reaction of an acid and a weak base. The pepsin is present in the solution (a) as free, probably negatively charged pepsin, and (b) in combination with the products of hydrolysis of the protein. These two forms are in equil. with each other and their relative concn. depends on the amt. of products of hydrolysis present in the soln. as demanded by the law of mass action. The reaction takes place between the ionized protein and the free pepsin. It is impossible at present to apply these results directly to the activities of the living organism since conditions there are much more complex. It is probable, however, that much of the apparent complexity is due to the fact that several processes, each simple in itself, occur simultaneously and thus lead to a complicated result. L. W. RIGGS

Quantum theory of vision (JULY) 3.

ARTHUR and STARRKE: *Elemente der physiologischen Chemie*. 4th Ed. revized and enlarged. Leipzig: Joh. A. Barth. 424 pp. M. 50 For review see *Z. angew. Chem.* 34, Aufsatzteil 133(1921).

CARRACIDO, JOSÉ RODRIGUES: *El reactivo bioquímico*. Madrid: Los Hijos de Tello. For review see *Rev. gén. sci.* 32, 91(1921).

GORSCHLICH, E. and SCHÜRMANN, W.: *Leitfaden der Mikroparasitologie und serologie. Mit besonderer Berücksichtigung der in den bakteriologischen Kursen gelehrteten Untersuchungsmethoden*. Ein Hilfsbuch für Studierende, praktische und beamtete Ärzte. Berlin: Jul. Springer. M 25, bound M 28.60.

## B—METHODS AND APPARATUS

STANLEY R. BENEDICT

**Method for testing the function of the liver by means of induced glucuronic acid excretion.** M. CHIRAY AND E. CAILLE. *Bull. mem. soc. med. hosp.* **45**, 383-95(1921).—The principle on which this test of hepatic function is based lies in the idea that since the liver is the main organ in which glucuronic acid is formed the introduction into the body of a compd. from which the acid may be produced, and the subsequent detn. of the amt. of glucuronic acid excreted in the urine, yields an index of the functional capacity of the liver. The test is called "induced glucuronuria," the administered substance is camphor, and it is best given in capsules containing 0.5 g. by oral route. The urine is immediately collected, the glucuronic acid detd. and a second specimen is tested 6 hrs. later. In normal individuals who have previously been on a low meat diet, and who have an empty intestine at the beginning of the test, the glucuronic acid rises within 6 hrs. from an initial value of about 20 to 30 mg. per l. of urine to about 80 mg. per l. as a result of the ingestion of the camphor. Similar increases are obtained when the camphor is administered as an oil enema, or subcutaneously. F. S. HAMMETT

**Rapid determination of albumin in the cephalorachidian fluid.** P. RAVAUT AND L. BOYER. *Presse médicale* 1920, 42; *J. pharm. chim.* [7] **23**, 281-4(1921).—A nephelometric method is described, in which the turbidity produced by the addition of a soln. of sulfosalicylic acid (prepd. by mixing 13 g. salicylic acid and 15 cc.  $H_2SO_4$  in a casserole, warming to melt the crystals formed, and, after cooling, dissolving in enough distd.  $H_2O$  to bring the vol. to 100 cc.), is compared with that produced by the addition of definite amts. of  $AgNO_3$  soln. to definite amts. of  $NaCl$  soln. The special graduations of the tubes to be employed are not given; the quantities of reagents and sample are simply measured by these graduations. F. F. HEYROTH

**New American methods for the colorimetric determination of glucose.** A. NEAU. M. D. Thesis, Montpellier, 1920, 38; *Physiol. Abstracts* **5**, 245.—The micro-picramic method of Lewis and Benedict for estg. glucose in small quantities of blood is compared with the cupro-molybdic method of Folin and Wu. Both methods can be employed for the cerebrospinal fluid. The cupro-molybdic method is preferable where there is N retention or excess of creatinine; in other cases the 2 methods give concordant results. The glucose in the cerebrospinal fluid is proportional to the glucose in the blood. Pathological cerebrospinal fluid should be compared not only with normal cerebrospinal fluid, but also with blood. E. H.

**Micro-determination of blood constituents by the method of Ivar Bang.** J. FEIGL. *Zentr. inn. Med.* **41**, 17-25(1920); *Physiol. Abstracts* **5**, 215.—General review of the possibilities of micromethods. E. H.

**Intravenous administration to mice, rats, and guinea pigs.** GEORGE B. ROTH. Hyg. Lab., U. S. Pub. Health Service. *Pub. Health Repts.* **36**, 661-5(1921).—The methods in the Hyg. Lab. are described. CHAS. H. RICHARDSON

## C—BACTERIOLOGY

A. K. BALLS

**Resistance of anthrax spores to chlorine, pickling liquors, formaldehyde, and mercuric chloride.** A. MÜLLER. *Arch. Hyg.* **89**, 363-72(1920); *J. Soc. Chem. Ind.* **40**, 319A.—A 1.5%  $Cl_2$  soln. killed the spores in 8 hrs; 0.5% soln. in 21 hrs. A pickle containing 0.5%  $HCl$  was ineffective even after 31 days; 4%  $HCl$  soln. at  $37^\circ$  killed the spores after 2 days; 2%  $HCl$  after 6 days; 1% and 0.5% after 7 days. 0.5% formaldehyde soln. killed the spores in 6 days; 5% in 5 days; 0.1%  $HgCl_2$  soln. was ineffective in 1 day, and 2% soln. in 88 days. At  $37^\circ$  0.1-5%  $HgCl_2$  soln. killed the spores in 20-5 days. G. C. BAKER

**Systematic investigations in the *Bacillus coli* group.** B. L. MONIAS. *Pharm. Monatshefte* 2, 29-38(1921).—A study of the morphology and biology of some 75 strains, each strain being tested from the standpoint of purity and motility, more especially however regarding its ability to coagulate milk, to yield indole and creatinine, as also acids and gas from various carbohydrates representing pentoses, hexoses, disaccharides, trisaccharides, alcohols and dextrin. Difference in behavior is made the basis for division of the several strains into definite groups, while the results in each case are presented in tabulated form.

W. O. E.

**Comparison of *Azotobacter* with yeasts.** M. MULVANIA. *Tenn. Agr. Expt. Sta. Bull.* 122, 1-6(1919); *Physiol. Abstracts* 5, 260.—Morphological, physiol., and fermentative comparisons of *Azotobacter* with yeast are reported. The disintegration of *Azotobacter* cells into a number of refractive bodies, which M. believes to be reproductive bodies, is likened to the spore-formation of yeast. The reported occasional reproduction of *Azotobacter* by means of buds, the occurrence of what is believed to be a morphological nucleus, and the comparative non-resistance of *Azotobacter* "spores" to heat are cited as evidence of a close relationship between these groups of organisms. M. contributes to the moot question as to whether certain forms of yeast can fix atm. N by the statement that he has succeeded in growing them in a N-free medium supplied with air which had been washed free of combined N.

E. H.

**The nature of yeast fat.** O. HINSBERG AND E. ROOS. *Z. physiol. Chem.* 111, 304 (1920).—Polemical in reply to MacLean and Thomas (*C. A.* 14, 3093). The authors have already pointed out (*Z. physiol. Chem.* 42, 189(1904)) that the so-called pentadecenoic acid prep'd. by them was a mixt. of much palmitic acid with another acid (probably stearic acid). They do not agree with MacLean and Thomas that the acid fraction from yeast fat, b. 130-50°, previously described by them, is a mixt. of lauric acid, oleic acid, and linoleic acid.

J. C. S.

**The supposed importance of vitamins in promoting bacterial growth.** J. W. McLEOD AND G. A. WYON. Leeds. *J. Path. Bact.* 24, 205-10(1921).—An attempt was made to investigate the relations between vitamins and bacterial growth, with a view to the use of bacterial growth as an index of the presence of vitamins. A simple phosphate agar was used chiefly, to which various exts. and chem. substances had been added. Especially striking results were obtained with kidney ext., which seemed to favor a vitamine hypothesis in so far as minute amts. of the substances were active. A comparison of the chem. and physical properties of staphylococcus stimulant of yeast with those of water-sol. B revealed serious discrepancies. The growth-promoting power of fresh blood or serum does not bear any definite ratio to the known vitamine content. Charcoal which is devoid of vitamine had an appreciable effect. Heating a serum partially destroys its growth-promoting power for the pneumococcus but not for the meningococcus.

JOHN T. MYERS

#### D—BOTANY

CARL L. ALSBERG

**Composition and properties of oat grain and straw.** R. A. BERRY. *J. Agr. Sci.* 10, 360-414(1920).—The expts. reported were performed at the expt. station of the West Scotland College of Agr., Kilmarnock, in a systematic study of the influence of variety, soil, climate, fertilizers, etc., on the compn., character and yield of oat grain and straw. A 3-lb. sample was taken and except in the case of imported oats, wild and native oats, "dressed" grain was used, air-dried for at least 24 hrs. In the mechanical analysis the following was det'd: Sepn. of the grain into kernel and husk; effect of humidity of the atm. upon the wt. of the grain; weekly variation in wt.; and variation of wt. during storage. The chem. analysis included detns. of H<sub>2</sub>O, crude fat (ether extract),

free fatty acids, crude fiber, ash, N,  $P_2O_5$ , and  $K_2O$ . The rate of absorption of, and distribution between, the straw and the grain of the various plant constituents during growth was studied. Changes in the compn. of the grain as it develops, individual grains in the spikelet and their compn., varieties of oats and their compn., nutritive value of oat grain, compn. and feeding value of oatmeal, meal power of the oat grain, effect of manuring on compn. of the grain, influence of locality upon the character of the grain together with the effect of the period of growth, soil and its effect, and compn. of imported oats and straw are dealt with in detail. The following is an abridged summary of a very extensive one given in the article: (1) Oat grain from the west of Scotland contained from 16–18%  $H_2O$  at harvesting; and from 12–14.5% during storage. Grain from the south of England and Wales contained 12.2% moisture. The wt. of stored grain varied, the max. variation amounted to between 4 and 5% of the initial wt. (2) Between 11 and 12% of the fatty substances in the oat kernel is present in the germ; the remainder, principally in the aleurone layer. Free fatty acids were almost absent in the oil from freshly ground kernel, but increased until in 24 days, calcd. as oleic acid, they formed over 55% of the extract. (3) Absorption of N and P compds. ceased when the kernel began to develop, while the absorption of P, ash and accumulation of dry matter, continued to maturity.  $P_2O_5$  and  $K_2O$  formed 50% of the wt. of ash absorbed by plants 2 months old, amounting to 26% at maturity. Migration of N, P, and K compds. from the straw, husk and chaff into the kernel proceeded until maturity. (4) The av.  $H_2O$  content of oatmeal at milling was 1.8%, increasing to 6.5 at the end of 50 days. The proportion of germ in 4 varieties varied from 2.6 to 4.8%, with a large amt. of oil and N, the latter in the chaff varied from 0.48 to 0.95%, and in the husk from 0.15 to 0.50% in varieties examd. The cultural conditions caused no change in oil content in the large or small size grains but caused a diminishing of the N as the size of the kernel increased. The larger grain gives the greater yield, wt. per bu. and proportion of kernel. The production of straw varies in the opposite direction to that of the yield of grain. Season produced little change in compn. of the grain, and moderate dressings of N, P, and K fertilizers, applied alone or mixed, produced less effect upon the size and compn. of the grain. Elevation, climatic and soil conditions were the cause of the greatest modification in the character of the grain. In 3 yrs. expts. the max. annual variation amounted to from 18 to 38% for the av. wt. of individual grains; 37–54% N; 17–29% oil; 17–35% ash and 21–31%  $H_2O$ .

R. B. DREMER

**Presence of loroglossin in several species of indigenous orchids.** P. DELAUNAY. Paris. *J. pharm. chim.* [7] 23, 265–72 (1921); *Compt. rend.* 172, 471–3 (1921); cf. C.A. 13, 1486.—Loroglossin was obtained from 5 species of orchids. The general process is described. The product so obtained from each of the species tested gave a currant-red color with concd.  $H_2SO_4$ , did not reduce Fehling soln., but was hydrolyzed by dil.  $H_2SO_4$ , with the formation of a red resin, and by emulsin with the formation of a white ppt. these tests are characteristic of loroglossin. The air-dried glucoside from *Orchis Simia* Lam. had  $\alpha_D = -41.43^\circ$  ( $v = 15$  cc.,  $l = 2$ ,  $\alpha = -24^\circ$ ,  $p = 0.0724$  g.); loroglossin, dried at  $110^\circ$  had  $\alpha_D = -42.97^\circ$ . 5 cc. of a soln. of 0.4826 g. glucoside per 100 cc. with 5 cc 5%  $H_2SO_4$ , heated 5 hrs. in a sealed tube in a boiling-water bath, had when cool  $\alpha_D = +8^\circ$  ( $l = 2$ ); 0.1151 g. reducing sugar, calcd. as glucose, per 100 cc. (47.6% of the glucoside. was formed. 5 cc. of the same soln., after hydrolyzing 9 days with emulsin at  $16-18^\circ$  had  $\alpha_D = +10^\circ$ , with the rotation due to the emulsin itself eliminated. The glucoside from *Orchis bifolia* L. had  $\alpha_D = -40.04^\circ$  ( $\alpha = -58^\circ$ ,  $p = 0.1207$  g.,  $v = 10$  cc.,  $l = 2$ ). This slightly low value may have been due to a trace of glucose; the soln. had a scarcely perceptible reducing action on Fehling soln. When 8 cc. of a soln. of 0.6035 g. glucoside and 2.5 g.  $H_2SO_4$  per 100 cc. were heated 13 hrs. on a boiling- $H_2O$  bath, the deviation passed from  $-29^\circ$  to  $+18^\circ$ , and 0.2918 g. glucose was formed per 100 cc. (48.33% of the

glucoside). In 8 cc. of a soln. of 0.6035 g. glucoside and 0.40 g. emulsin per 100 cc., after 10 days at 30°,  $\alpha_D +12'$ ; 0.2305 g. glucose per 100 cc. was formed (38.19% of the glucoside). The glucoside from *Cephalanthera grandiflora* Balingt. crystd. 3 times from anhydrous acetone and dried 2 hrs. at 110°, had  $\alpha_D = 4-2.38^\circ$  ( $\alpha = -50'$ ,  $p = 0.0983$  g.,  $v = 10$  cc.,  $l = 2$ ). After keeping 8 cc. of the soln. of 0.4915 g. glucoside and 2.5 g.  $H_2SO_4$  per 100 cc. 2 hrs. in an autoclave at 105°, the rotation passed from  $-25'$  to  $+16'$ , and 0.240 g. glucose (49.03% of the glucoside) was formed. The rotation of 8 cc. of a soln. of 0.4915 g. glucoside and 0.40 g. emulsin per 100 cc. changed, after 35 days at 30°, from  $-25'$  to  $+14'$ , while 0.2326 g. glucose (47.52% of the glucoside) was formed. The air-dried glucoside from *Ophrys aranifera* Huds., had  $\alpha_D = -40.88^\circ$  ( $\alpha = -46'$ ,  $p = 0.1405$  g.,  $v = 15$  cc.,  $l = 2$ ). 10 cc. of a soln. of 0.4683 g. glucoside and 2.5 g.  $H_2SO_4$  per 100 cc., after being heated 10 hrs. in a sealed tube on a boiling- $H_2O$  bath, had  $\alpha = +15'$ ; 0.2875 g. glucose was formed (50.7% of the glucoside). In 10 cc. of a soln. of 0.4683 g. glucoside and 0.40 g. emulsin per 100 cc., after 10 days at 16-18°,  $\alpha = +14'$ ; 0.2045 g. glucose was formed (43% of the glucoside). The glucoside from *Ophrys apifera* Huds., twice crystd. from anhydrous acetone and dried at 110° for 2 hrs., had  $\alpha_D = -42.81^\circ$  ( $\alpha = -41'$ ,  $p = 0.0798$  g.,  $v = 10$  cc.,  $l = 2$ ). 10 cc. of a soln. of 0.399 g. glucoside and 2.5 g.  $H_2SO_4$  per 100 cc., after two hrs. in an autoclave at 105°, changed from  $-20'$  to  $+12'$ ; 0.1923 g. glucose per 100 cc. was formed. The action of emulsin was not detd. quantitatively. The products from all 5 species m. 137-140°, faint divergencies were due either to slight amts. of impurities or to lack of sharpness of melting. That the rotatory power was below  $-42^\circ$  in 3 cases was due to the fact that the observations were made on very dil. solns. The amts. of glucose formed by  $H_2SO_4$  hydrolysis, 47-50%, varied with exptl. conditions, but were near the value found by Bourquelot and Bridel for loriglossin (51%). With emulsin the amts. of glucose (39.18-47.52%) showed hydrolysis to be slow. Temps. over 30° did not aid it materially. Loriglossin is probably widely distributed through the various genera of orchids.

F. F. HEVROTH

The hydrocyanic acid question. VI. The hydrocyanic acid content of cherry-laurel leaves. L. ROSENTHALER. Bern. *Schweiz. Apoth. Ztg.* 59, 10-13, 22-6(1921); cf. C. A. 14, 76, 558, 2361.—To det. whether there is more HCN in young than in old leaves of the same yr., R. estd. the HCN content of individual leaves of the same twig by the Liebig-Denigès method, using 0.02 N  $AgNO_3$  in place of 0.1 N. Wester (C. A. 8, 1807, 1848) and Juillet previously found that the HCN content decreases from month to month; K. Siegfried (C. A. 3, 285) found that young leaves give a less active water than older ones. Three series of results on *Prunus laurocerasus* var. *schipkaensis*, *Prunus laurocerasus* A and B showed that each successive leaf from the bottom (av. 0.14%) to the top (0.45%) of the stem has relatively more HCN than the previous one; the youngest undeveloped leaves have markedly high percents (up to 0.45%) HCN. This regularity was not observed in Aug.-Sept. leaves, although an effort was made to remove brown HCN-free spots from these leaves. In series IV-VI the HCN content varied, but the differences were not as great as in the younger leaves. Series VII, made in April, showed a fairly regular increase of HCN in the later leaves. Series VIII, made on leaves of the preceding year, showed no increase in HCN in the succeeding leaves. R. also compared the amts. of HCN in the left and right halves of leaves at different times to see if there is uniform distribution of the acid in the leaves. Series IX-XIII (48 detns.), showed identical amts. of HCN (0.10-0.21 each in different leaves) in the two halves; any differences noted were very slight. The middle nerve usually contained more HCN than the tissues of the leaf, e. g. as high as 0.46% as compared with an av. 0.20%. This difference was most marked in the younger leaves. Series XIV-XVI (35 detns.) showed that the outer and inner parts of the halves of the leaves have the same HCN content. The same was true of the upper and lower portions



of the leaves studied in June, July, Sept. Each leaf is a chemical individual, varying slightly from its neighbors on the same stem. F. F. HEYROTH

**Investigation of the first products of the chlorophyll assimilation of carbon.** E. ROUGE. *Schweiz. Apoth. Ztg.* **59**, 157-61, 175-8(1921).—The history of the problem of CO<sub>2</sub> absorption by plants is reviewed. The reaction with Schiff's reagent, carried out by Kimpflin, is not necessarily specific for CH<sub>2</sub>O *in vivo*. The Willstätter-Gudel reaction, in which the color produced by materials other than an aldehyde is removed by picric acid-ether treatment, showed that the color was left only at the vegetative points and the young membranes. The coloration obtained by Kimpflin by the addition of metol to the tissues of *Agave mexicana* was due to oxidation and not to formol. In attempts to detect formol, after adding 2% soln. of phenylhydrazine-HCl by the Rimini-Schryver reaction (sensitive to 1:1,000,000) R. failed to show the presence of the slightest trace. A test for glycolaldehyde consists in warming it 10 min. on a H<sub>2</sub>O-bath with a trace of *p*-nitrophenylhydrazine. The hydrazone formed is extd. by hot 60% EtOH. Crystd. from acetone, *p*-nitrophenylhydrazone of glycolaldehyde forms red-brown needles, m. 177° with decompn., and dissolves in alc. KOH with a blue color. Under the same conditions formol gives yellow needles, changing to red-violet with alc. KOH. Attempts to detect glycolaldehyde, glyceraldehyde, or dihydroxyacetone in plant sections proved fruitless, with the exception of those made with *p*-nitrophenylhydrazine-HCl. In leaf sections exposed to light and floating on the reagent there appeared near the chloroplasts reddish granulations, which became blue when treated with alc. KOH; sections kept dark did not show them. In all cases the ligneous elements, as elder pith, were colored intensely violet instantly on treatment with the reagent. 1500 g. leaves, deprived of their middle nerves, were minced in the presence of 2% aq. soln. (11.) of anhydrous NaHSO<sub>3</sub> (to join with the aldehyde and prevent enzyme action), added a little at a time, and then ground. To the juice from the pressed paste, concd. on the H<sub>2</sub>O-bath and filtered, was added dil. HCl. Formol, glyceraldehyde and dihydroxyacetone were absent when tested for in a small portion of the soln. 60 cc. freshly prepd., satd. aq. soln. of *p*-nitrophenylhydrazine-HCl was added to the remainder. After 15 min. on the H<sub>2</sub>O-bath, the red ppt. was filtered, washed with H<sub>2</sub>O, dried, dissolved in pyridine and pptd. by toluene or benzene. Hydrazones were dissolved from the red powder by repeated treatments with 60% EtOH. The ppt. formed after a time in the filtered liquid was collected, dried, and washed with cold acetone. It consisted of red-brown needles, m. 177°, becoming blue with alc. KOH, and was the *p*-nitrophenylhydrazone of glycolaldehyde. Potato leaves (2 kg.) gave 0.1 g. crude substance, leaving only 0.04 g. final product, corresponding to 0.012 g. glycolaldehyde. Similar results were obtained from the leaves of half-sugar beets, apricot, hornbeam, glycine, oats, and *Acer negundo*. With the latter the mixed leaves gave the test, but the white leaves gave an insignificant amt. Leaves collected at night gave less than those collected during the day. A control test showed that the glycolaldehyde was not formed by the reduction of oxalic acid by NaHSO<sub>3</sub>. A theory for the formation of glycolaldehyde and O<sub>2</sub> by the action of CO<sub>2</sub> upon chlorophyll, with the formation of a peroxide, two mols. of which decompose under the influence of an enzyme, is put forward, but it is still too soon to state that glycolaldehyde is the first product of CO<sub>2</sub> assimilation. F. F. HEYROTH

**The honey locust tree (*Gleditsia triacanthos*, Linn.).** H. W. PORRS. *Agr. Gas. N. S. Wales* **31**, 85-90(1920); *Physiol. Abstracts* **5**, 200.—The percentage compn. of the bean of *Gleditsia triacanthos* is given. The albuminoid ratio is 1:4.6. E. H.

**Studies on the proliferation of the hollow medullary cells in the stems of *Vicia faba*, L.** Y. OKADA. *Bot. Mag. Tokyo* **34**, 19-34(1920); *Physiol. Abstracts* **5**, 258-9.—Cell proliferation was induced in the pith of the stem of *Vicia faba*, L., by injection with distd. water. The addition of salts of Cu, Zn, etc., did not modify the result of the

injections. Low temps. exercised an unfavorable influence on this induced cell proliferation. The nature of the cell membrane in the abnormal tissues did not differ substantially from that of the normal pith cells. The cells in the intumescences contained a substance which was colored red with  $H_2O_2$ . An accumulation of acids was found in these cells.

E. H.

**Annual Report University Idaho, Agricultural Experiment Station, 1917, 1918.** ANON. *Bull.* 104, 1-51; *Physiol. Abstracts* 5, 158.—The carbohydrate changes which take place in the apple during growth, ripening and storage are discussed and summarized. The results of preliminary expts. dealing with the action of sp. enzymes in the cell are recorded.

E. H.

**Composition of linseed recovered from home-grown flax.** T. W. FAGAN. *Scottish J. Agric.* 2, 491-8(1919); *Physiol. Abstracts* 5, 151.—Analysis of seed samples from crops grown in Scotland for fiber showed that the oil content of the seed was 36, approaching the 39% of the original Dutch seed. The growth of flax is popularly held to be undesirable owing to the undue exhaustion of the land thereby. By comparison of N, P, and potash contents of flax with those of common crops, F finds that the exhaustion of the soil by flax is about the same as by the av. cereal crop. The method of harvesting (removal of the whole plant) is thought to be the cause of the exhausting properties attributed to flax.

E. H.

**The influence of ultramarine on plants.** F. KRYZ. *Z. Pflansenkrankheiten* 29, 161-6(1919); *Physiol. Abstracts* 5, 155.—Seeds of plants germinate more slowly and the subsequent plants are retarded in growth by the presence of ultramarine in the soil, though no toxic action of this substance could be detected.

E. H.

**The growth of Lemna plants in mineral solutions and in their natural medium.** W. B. BORROMLEY. King's Coll. London. *Ann. Botany* 34, 345-52(1920).—As a further check on results obtained previously (cf. *C. A.* 11, 2816) *Lemna minor* was grown in Detmer's soln., in Knop's soln., in the latter + the aq. ext. of 1 g. bacterized peat per 1000 cc., and in pond water. Knop's soln. proved no better than Detmer's. The following results were obtained for Knop's soln. and for Knop's soln. + ext. of peat, resp., in 8 weeks: number of plants, 327,775; wt. of plants, 29.2, 124.0 mg.; wt. of 100 plants, 8.9, 17.3 mg. The plants in pond water grew well but did not multiply as rapidly as in Detmer's soln. probably due to the lower concn. of minerals. *Lemna major* was grown in Detmer's soln., in Knop's soln., and in each with the addition of an ext. of bacterized peat. The results were similar to those obtained with *L. minor*.

T. G. PHILLIPS

**The effect of organic matter on the growth of various water plants in culture solution.** W. B. BORROMLEY. *Ann. Botany* 34, 353-65(1920); cf. preceding abstract.—*Lemna major* was grown in 4 sets of culture solns. (1) Detmer's soln. (2) Detmer's soln. + the crude nucleic acid derivs. from 1 g. of raw peat in 500 cc. (3) Detmer's soln. + 1 g. of autoclaved azotobacter growth in 1000 cc. (4) Detmer's soln. + 1 g. aq. ext. of bacterized peat in 500 cc. Culture 4 gave the largest number of plants, and culture 3 slightly the greatest dry wt. per 100 plants. To det. whether the requirement for org. matter is general with water plants the following species were grown in Detmer's soln. and in Detmer's soln. + aq. ext. of bacterized peat: *Salvinia natans*, *Azolla filiculoides* and *Limnobium stoloniferum*. The org. matter added in no case exceeded 184 parts per million. The concn. of the salts in the soln. totalled 5500 parts per million. In all cases the org. matter very markedly favored growth. The more rapid the rate of multiplication of the plants the quicker was the response to the addition of org. matter to the soln. The response of *A. filiculoides* was rather slow probably due to the presence of a symbiotic alga, *Anabaena*.

T. G. PHILLIPS

**Field studies of the carbon dioxide absorption of coconut leaves.** F. T. McLEAN. Univ. of Philippines. *Ann. Botany* 34, 367-89(1920).—Absorption of  $CO_2$  by leaves

either detached or in place was detd. by enclosing them in a wide glass tube one end of which was open. The other end led through tubes in which  $\text{Ba}(\text{OH})_2$  was used to absorb  $\text{CO}_2$ . A slow stream of air was drawn through the app., and at the same time and rate a stream was drawn through a similar app. in which no leaf was enclosed. The difference in  $\text{CO}_2$  absorbed by the two sets is due to absorption by the leaf. Middle-aged leaves absorb  $\text{CO}_2$  faster than either immature or old leaves. Coconut leaves show a max. rate of absorption in the morning, a depression at midday and a second rise in the afternoon followed by a decline toward sunset. Leaves of the sugar cane absorb  $\text{CO}_2$  much more rapidly than those of the coconut or abaca. T. G. PHILLIPS

**Osmotic properties of some plant cells at low temperatures.** FRANCIS J. LEWIS AND GWYNETH M. TUTTLE. Univ. Alberta. *Ann. Botany* 34, 405-16(1920).—Osmotic pressures, elec. conds. and the amts. of sucrose, maltose and glucose were detd. in the leaf tissues of *Picea canadensis*, *Pyrola rotundifolia*, *Linnaea borealis*, and the cortical tissue of *Populus tremuloides*, at intervals from autumn until summer. The max. osmotic pressure is reached in *Picea* and *Linnaea* toward the end of March, in December in *Populus* with a second max. in March. In *Pyrola* there is a fairly steady decrease from December until June. There was little variation in the concn. of electrolytes. Changes in sugar content follow closely changes in osmotic pressure. In the living leaves of *Pyrola* ice formation does not begin until a temp. of  $-31.6^\circ$  is reached. T. G. PHILLIPS

**Studies in the energy relations of plants. I. The increase in area of leaves and leaf surface of *Cucumis sativus*.** F. G. GREGORY. *Ann. Botany* 35, 93-123(1921).—A method for estg. the area of a leaf in place is described and the errors are calcd. The increase in leaf area of several sets of plants of *Cucumis sativus* under different conditions was measured and the results are discussed mathematically. The curve of increase in area of a single leaf in daylight is of S form and may be represented by the formula for an autocatalytic reaction in which the material catalyzed gradually decreases in amt. A modification of this formula represents the growth of a single leaf in artificial light. The increase in total leaf area of plants grown in daylight in March and June closely follows the compound interest law. For plants grown in December or in artificial light the relationship is more complex and shows the action of a detrimental time factor which may be due to the high temp. maintained. T. G. PHILLIPS

**Relation of potassium to growth in plants.** T. O. SMITH AND O. BUTLER. *Ann. Botany* 35, 189-225(1921).—Wheat, corn and Japanese buckwheat were grown in water cultures, and wheat and corn in sand. Complete mineral solns. and also solns. lacking K were used. To some of the latter K was added after periods of from 3 to 22 days. The K reserve of the seed is sufficient to maintain normal growth only for a very short time. Without K the axis is dwarfed and progressive death of the foliage occurs beginning with the older leaves. Recovery from K starvation occurs the more slowly the longer the K is withheld. The amt. of dry matter formed by a plant is not proportional to the amt. of K absorbed. T. G. PHILLIPS

**Fluorescence and the condition of chlorophyll in living cells.** KURT STERN. *Ber. botan. Ges.* 38, 28-35(1920); *Z. Botan.* 13, 193-230(1921).—Studies were made of the fluorescence of living cells, principally of *Chlorella*, and of various chlorophyll preps., blue light being used. The cells of *Chlorella* are fluorescent as are also those of the leaves of many species. Colloidal and solid chlorophyll do not fluoresce noticeably. Chlorophyll in cells is in true soln. in lipoids. Observations of the fluorescence of cloudy solns. or plant tissues with the unaided eye are inaccurate. T. G. PHILLIPS

**Physiological effects of osmium tetroxide.** RUD. SEHLIGER. *Ber. botan. Ges.* 38, 176-84(1920).—Wheat seed is not killed by several hours in a soln. of  $\text{OsO}_4$  up to 1%. Germination and growth are retarded and the final size of the leaf is reduced. The active parenchyma cells of the red beet are very sensitive to  $\text{OsO}_4$ . T. G. PHILLIPS

**Carbon dioxide assimilation in *Neottia*.** FRIEDL WEBER. Univ. Graz. *Ber. botan. Ges.* 38, 233-42(1920).—*Neottia* contains chlorophyll *a* or a substance producing it, but little or no chlorophyll *b*. Attempts to det. whether CO<sub>2</sub> assimilation occurs in this plant have led to conflicting results. W. finds that starch is nearly if not quite as abundant in plants whose inflorescence develops in the dark as in those exposed to light. The indigo carmine method indicates that some O is liberated in light. The results are not conclusive, but it seems that if photosynthesis occurs it is of relatively little importance to the plant.

T. G. PHILLIPS

**The silver-reducing cell substance in leaves.** FRIEDRICH CZAPEK. *Ber. botan. Ges.* 38, 246-52(1920).—The silver-reducing power of chloroplasts is lost on their death. C. finds this loss due to the diffusion from the chloroplasts of a substance like Fischer's depsides. The isolation and study of this substance are in progress.

T. G. PHILLIPS

**The effect of neutral salts on acid resistance, permeability and life duration of protoplasts.** WIDAR BRENNER. Univ. Helsingfors. *Ber. botan. Ges.* 38, 277-85(1920).—Small pieces of the endodermis of red cabbage leaves were treated with varying concns. of HCl in the presence of sucrose, glucose, or neutral salts of concns. to cause equal plasmolysis. Change in the color of the pigment indicates penetration of the acid. Normal plasmolysis and recovery show that the cell has not been killed. The H-ion concns. of the solns. were detd. The critical HCl concn. varied from 0.004 to 0.001 *N*, the H-ion concns. from  $5.5 \times 10^{-3}$  to  $8.9 \times 10^{-4}$ . Antagonism between H<sup>+</sup> and other ions was shown. KCl, Ca(NO<sub>3</sub>)<sub>2</sub>, MgCl<sub>2</sub>, CaCl<sub>2</sub> in increasing order, lessened the toxicity of H<sup>+</sup>. NaCl, Mg(NO<sub>3</sub>)<sub>2</sub>, MgSO<sub>4</sub> and KNO<sub>3</sub> had little effect. K<sub>2</sub>SO<sub>4</sub> increased the toxicity of H<sup>+</sup>. Salts of Ca and Mg prevent, for days, the diffusion of pigment from dead cells. Mg salts killed the cells quickly, those of Na and K less rapidly. Cells remained alive 2 months in a soln. containing salts in about the same proportion as in sea water but concd. enough to cause plasmolysis. The use of such balanced solns. instead of a single salt in plasmolysis expts. is recommended.

T. G. PHILLIPS

**A new factor determining color in the Cyanophyceae.** K. BORESCH. *Ber. botan. Ges.* 38, 286-7(1920); *Z. Botan.* 13, 65-79(1921).—Lack of Fe causes a change in the color of *Phormidium Reizii* from olive-green through violet and red to yellow-brown. Both chlorophyll and the chromoprotein are decreased. If N is abundant the addition of Fe causes a return to the usual color.

T. G. PHILLIPS

**Contributions to the microchemistry of plants.** XIV and XV. HANS MOLISCH. *Ber. botan. Ges.* 38, 299-306(1920); cf. *C. A.* 13, 2897, 2898.—XIV. The blue color caused in plant ash by chlor zinc iodide. The color is ascribed to the formation of Zn(OH)<sub>2</sub> or a basic carbonate in the form of a gel which takes up I, giving a blue color. Not all plants containing large amts. of oxalate crystals yield an ash giving this color. The color is given in the presence of Na<sub>2</sub>CO<sub>3</sub> or K<sub>2</sub>CO<sub>3</sub>, but not by CaCO<sub>3</sub> or CaO. XV. The separation of drops of fat on an apple. Very small drops of liquid fat were found on the surface of fruits of *Malus coriarius*.

T. G. PHILLIPS

**The amyloid of young organs.** Amyloid in growing root hairs and its relation to cell growth. H. ZIEGNSPECK. *Ber. botan. Ges.* 38, 328-33(1921).—A study of the growth of root hairs supports the view that amyloid is intermediate in the formation of cellulose walls (cf. *C. A.* 14, 2344). Amyloid stretches easily and is not elastic. Its location in the cell wall therefore det. the direction of growth. In root hairs the amyloid is localized in the growing tip.

T. G. PHILLIPS

**The effect of saponins on plant cells.** FRIEDRICH BOAS. *Ber. botan. Ges.* 38, 350-3(1921).—Saponin increases the permeability of the plasma membrane. It increases the rate of the fermentation of sugar by yeast. This effect is overcome by the addition of Na salts. Yeast treated with saponin is no longer capable of vital staining, probably due to the pptn. of the stain by the saponin. The permeability of the cells

of higher plants is also increased by saponin, still further by saponin and neutral salts. This is measured by the diffusion of anthocyanins or tannins from the cell. T. G. PHILLIPS

**The influence of sodium chloride on the development of *Sterigmatocystis nigra*.** MARIN MOLLIARD. *Compt. rend.* 172, 1118-20(1921).—*S. nigra* was grown in solns. contg. minerals and sucrose. To some of these NaCl was added in amts. varying from 0.25 to 12%. Conidia formation was greatly lessened at 1.0% NaCl and was prevented at 3.0%. With increasing concn. of NaCl the total dry wt. produced decreased, the time required to reach max. dry wt. was lengthened, and the efficiency of sucrose in producing dry wt. decreased. The suppression of conidia formation seemed to be due largely to the accumulation of  $\text{HNO}_3$  from the  $\text{NH}_4\text{NO}_3$  used, in the presence of NaCl. If  $\text{NH}_4$  tartrate was used instead of  $\text{NH}_4\text{NO}_3$ , conidia formation was retarded but not prevented. T. G. PHILLIPS

**Lathyrism or intoxication caused by seeds of the chick-pea.** MARCEL MIRANDE. *Compt. rend.* 172, 1142-3(1921).—The crushed or ground seeds of *Lathyrus sativus*, moistened with  $\text{H}_2\text{O}$  and kept at  $35-40^\circ$ , in a few hours undergo autofermentation liberating  $\text{CO}_2$  and  $\text{H}_2\text{S}$ . The mother substance of the  $\text{H}_2\text{S}$  is in the cotyledons and is extd. completely by thorough washing with  $\text{H}_2\text{O}$ . Whole seeds do not give off  $\text{H}_2\text{S}$  when moistened. The fermentation does not occur below  $35^\circ$  nor above  $60^\circ$ . The mother substance is partially decompd. by boiling. Decompn. is hastened by dil. acid. The toxicity of these seeds to animals is probably due to the liberation of  $\text{H}_2\text{S}$  in the digestive tract. T. G. PHILLIPS

**Seeds of the family Papilionaceae undergoing hydrogen sulfide fermentation.** MARCEL MIRANDE. *Compt. rend.* 172, 1202-4(1921).—Under the conditions mentioned (cf. preceding abstract)  $\text{H}_2\text{S}$  is liberated abundantly from seeds of *Lathyrus odoratus*, *Phaseolus vulgaris*, *Pisum sativum*, several species of *Faba* and *Vicia*, *Cicer arietinum*, *Medicago sativa* and *Lupinus albus*. Several other species yield smaller amts. The  $\text{H}_2\text{O}$  in which the seeds are cooked contains the larger part of the mother substance. T. G. PHILLIPS

**The occurrence of raffinose in the seeds of *Nelumbo nucifera*.** HUMUO HEMMI. *J. Coll. Agr. Hokkaido Imp. Univ.* 9, 249-60(1921).—The cotyledons of the seeds of *Nelumbo nucifera* contain nearly 6% non-reducing sugars. A small amt. of sucrose is present, but much the larger part is raffinose. The sugar was sepd. and identified. T. G. PHILLIPS

**The effect of the reaction of a nutritive solution on germination and the first stages of plant growth.** RALPH M. HIXON. *Medd. Vetenskapsakad. Nobelinst.* 4, No. 9, 28 pp.(1920).—As culture solns. the following were used: Tollen's soln., tap water, sterilized agar and tap water, to each of which NaOH or HCl were added to produce the desired reaction, and the salts of Tollen's soln. in tap water. Growth was estd. by length of roots and plumules. Seeds germinated over a wide range,  $p_H$  4-7.6, with only slight variations at the two extremes. In the central part of this range there is a point of decreased germination. For peas this is at  $p_H$  5, for corn, wheat and oats at  $p_H$  6; for carrots at  $p_H$  5.5. The root growth of carrots was a max. at this point at the end of 10 days. For the other plants the critical point gave a minimum root growth lasting for 15-20 days. It is suggested that this critical point may be the isoelectric point of a protein of the cell membrane of the seed. In general the growth of plumules was less affected at this point than was the growth of roots. T. G. PHILLIPS

**The relation of salt proportions and concentrations to the growth of young wheat plants in nutrient solutions containing a chloride.** SAM F. TRELBASE. *Philippine J. Sci.* 17, 527-603(1920).—Wheat seedlings were grown in a 4 salt soln. contg.  $\text{Ca}(\text{NO}_3)_2$ ,  $\text{MgSO}_4$ ,  $\text{KH}_2\text{PO}_4$  and KCl. Each salt was varied so as to make from 0.1 to 0.7 of the total osmotic concn. which was 1.60 atm. Solns. were changed every 4th day. Evapn. was detd. The drv wts. of tops and roots were detd. at the end of 24 days. In another

states the concn of KCl was increased to 0.9 of the total. Four salt proportions, including some of the best and poorest, were used in another series in which the total osmotic concn. was varied from 0.5 to 7.0 atm. The addition of KCl gave no marked differences from Tottingham's four salt soln. or Shive's 3 salt soln. No injurious or retarding effect was observed that could be ascribed to the KCl. The poorer growth in high concns. of KCl was attributed to the small amts. of the other salts present. In general, differences in dry wt. of roots paralleled those in dry wt. of tops.

T. G. PHILLIPS

**Presence of copper in plants particularly in foods of vegetable origin.** B. GUERTRAULT. *Compt. rend.* 171, 196-8(1920); cf. *C. A.* 7, 1465; MAQUENNE AND DEMOUSSY, *C. A.* 14, 962, 1177, 2010.—Cu was detd. by incineration, treatment of the ash with HCl, sepn. of Cu as sulfide, transformation to  $\text{Cu}(\text{NO}_3)_2$ , electrolysis and direct weighing of the metal or colorimetrically after the addition of  $\text{NH}_3$  to the soln. of  $\text{Cu}(\text{NO}_3)_2$ . The amt. of vegetable or food used ranged from 200 g. to 1 kg. In mg. per kg. of fresh green vegetables or fruits, the Cu ranged from 1.1 in pumpkin to 5.0 in leek. In grains and leguminous seeds its range was from 6.4 in decorticated rice to 17.1 in oats.

L. W. RIGGS

**Hydrogen-ion concentration relations in a three-salt solution.** HENRY F. A. MEIER AND CLIFTON E. HALSTED. *Soil Sci.* 11, 325-51(1921).—Fulcaster wheat was grown for a period of 35 days in water cultures contg.  $\text{KH}_2\text{PO}_4$ ,  $\text{Ca}(\text{NO}_3)_2$ , and  $\text{MgSO}_4$  in varying proportions and having a total osmotic value of 1.0 atm. The solns. were changed at  $3\frac{1}{2}$  day intervals and the hydrogen-ion concn. detd. at each change. No given combination of the 3 salts gave a constantly max. yield of tops, roots or total dry wt. in the 3 sets grown at different periods. The cultures having the max. dry wts. had the minimum water requirement. The H-ion concn. of solns. in which wheat has been grown became less than the initial reaction of the soln. All cultures were acid at the beginning and tended to become neutral. There was no apparent direct correlation between the yield of the plants and the  $p_H$  or the change in  $p_H$  of the solns. Degrees of acidity which have proved inhibitory to *Actinomyces* and *Azotobacter* had no observable effect upon the growth of the wheat plant.

W. J. ROBBINS

**The growth curve of plants.** AUGUST RIPPEL. *Landw. Vers. Sta.* 97, 357-80(1921).—A discussion of the formulas as proposed by Mitscherlich and Robertson and their application.

F. M. SCHERTZ

## E—NUTRITION

PHILIP B. HAWK

### NORMAL

**Vitamines.** BICE NEPPI. *Giorn. chim. ind. applicata* 2, 573-80(1920).—Critical review. A short bibliography is appended. ROBERT S. POSMONTIER

**The vitamins.** W. H. EDDY. *Abstracts Bacteriol.* 3, 313-30(1919); *Physiol. Abstracts* 5, 185.—A useful bibliographical review with 236 references. H. G.

**Vitamines.** W. D. HALLIBURTON. *Scientia* 27, 65-62(1920); *Physiol. Abstracts* 5, 185.—A general account of the subject, written in a manner intended to be understood by the workers in other branches of science. H. G.

**Vitamines.** W. RAMSDEN. *Dental Rec.* 40, 281-7(1920); *Physiol. Abstracts* 5, 239.—A good general account, much of which is culled from the recent report of the Medical Research Council, and adapted to the education of dentists on the matter. H. G.

**Role of vitamins in nutrition.** HARRIETTE CHICK. *Wien. med. Woch.* 70, 411-9(1920); *Physiol. Abstracts* 5, 240. H. G.

**Nutrition and public health with special reference to vitamins.** J. F. MCCLENDON. *Amer. J. Med. Sci.* 159, 477-96(1920); *Physiol. Abstracts* 5, 239. H. G.

**Protein metabolism.** D. NORL PATON. *Brit. Assoc. Repts.* 1919, 294-307; *Physiol.*

*Abstracts* 5, 242.—Special attention is directed to the origin, significance, and fate of guanidine, creatine, and creatinine. H. G.

**Alimentary and vitamin ration.** A. DESGREZ AND H. BIERRY. *Compt. rend.* 172, 1068-71(1921); cf. *C. A.* 15, 1154.—Adult rats were maintained in equil. for a time then subjected to a diet in which the carbohydrate was removed and the calorific value of the ration maintained by an increase of fat. The N balance became negative on the next day after the substitution. If this feeding is not too prolonged a reduction of the fat and an addition of the minimum of carbohydrate will restore N equil. If the fat of the ration is isodynamically replaced in small measure by albumins and the remainder of the deficiency by carbohydrates the animals rapidly lose wt. and the N and P balances become negative. If after 7 days of this feeding, fresh butter is added to the ration the loss of N is rapidly arrested. Therefore each species of food exercises a functional role and must be present in the ration in sufficient quantity in order that equil. may be maintained. L. W. RIGGS

**Influence of heat and oxidation upon the nutritive and antiscorbutic properties of cow milk.** EDLA V. ANDERSON, R. ADAMS DUTCHER, C. H. ECKLES AND J. W. WILBUR. *Science* 53, 446(1921); cf. *C. A.* 15, 550.—The exptl. milk was from an Ayrshire cow fed upon a ration composed of the same types of feeding materials throughout the period in order to eliminate fluctuations in vitamin content or nutritive value. Expts. were made with 163 guinea pigs in several series and control groups were included in each series. Boiled milk was found to be practically equal, in nutritive properties, to fresh, unheated raw milk. Pasteurized milk, heated to 83° for 30 min., produced scurvy "and all of the animals died in a very short time." The pasteurized milks had been stirred violently by motor-driven propellers, while the boiled milk had not been stirred mechanically. This fact indicated that oxidation had occurred in the pasteurizing process, and led to the testing of nutritive properties, after various degrees of oxidation by bubbling air or O through milk or by treatment with H<sub>2</sub>O<sub>2</sub>. O and H<sub>2</sub>O<sub>2</sub> will destroy the antiscorbutic accessory at room temp. and the destruction is hastened as the temp. rises. Milk may be pasteurized in closed vessels without appearing to lose its nutritive and antiscorbutic properties when fed to guinea pigs. Milk through which CO<sub>2</sub> has been bubbled compares favorably in nutritive properties with untreated milk. Antiscorbutic properties of orange juice are not destroyed by boiling for 30 min. but H<sub>2</sub>O<sub>2</sub> destroys the antiscorbutic factor at room temp. and more rapidly if heated. Oxidation therefore appears to be a more important factor than heating as far as nutritive and antiscorbutic properties of milk are concerned. L. W. RIGGS

**Change in the fat of peanut-fed rabbits.** S. T. DOWELL. *Okla. Expt. Sta. Science* 53, 487(1921).—To det. whether an animal in starving uses the liquid fat more rapidly than it does the solid fat, rabbits were fed on peanuts and alfalfa for 6 weeks, when one of the rabbits was killed; the others were killed after starving 3, 5 and 7 days. Chem. examn. of the fat of the 4 animals showed a progressive decrease in the iodine number of the back fat from 96.23 to 66.22, a decrease in the iodine number of the kidney fat from 98.00 to 92.36, and a progressive increase in the percent of the liver extd. by ether from 8.15 to 20.09. The iodine numbers of the liver exts. remained between 98 and 104. It thus appears that the liquid fat of an animal during starvation is used more rapidly than the solid fat, and that the liquid fat of the back or subcutaneous fat is used more rapidly than that of the kidney. The work is to be repeated using pigs instead of rabbits. L. W. RIGGS

#### ABNORMAL

**Protein diets and undernutrition in treatment of diabetes.** F. M. ALLEN. *J. Amer. Med. Assoc.* 74, 571-7(1920); *Physiol. Abstracts* 5, 128; cf. *C. A.* 14, 2385.—A possible form of low calorie-diet after fasting is one composed wholly or chiefly of protein, and this plan has seemed most useful. H. G.

**The nervous lesion of beriberi.** F. M. R. WALSHE. *Med. Sci., Abstr. and Reviews* 2, 41-6(1920); *Physiol. Abstracts* 5, 135.—A review of recent work, which is noteworthy, as it emphasizes the necessity of search for a positive agent in producing the neuritic symptoms which are quite on all fours with those caused by certain poisons. The negative aspect of the question (lack of vitamine) needs supplementing by attention to the question if the lack causes a poison to develop and, if so, what is the poison?

H. G.

#### F—PHYSIOLOGY

ANDREW HUNTER

**Observations on the body temperature of dry cows.** MAX KRISS. Pa. State College. *J. Agr. Research* 21, 1-28(1921).—No chem. data are given. F. C. COOK

**The physiological cost of muscular work.** A. D. WALLER. *Brit. Med. J.* 1, 537-8 (1920); *Physiol. Abstracts* 5, 136.—The av. rate of energy output (gross) of 4 compositors for 1 week was 101 to 105 cal. per hr. H. G.

**Adrenal functions in white rats.** H. V. EXNER. *Dublin J. Med. Sci.*, April 1920, 79-89; *Physiol. Abstracts* 5, 142.—White rats survive removal of both adrenals. Asphyxia both in those with and without adrenals causes a fall of blood pressure, unless they are curarized, when the usual rise occurs. "Sugar puncture" causes glucosuria in normal rats, but not in those without adrenals. In the latter animals, excitation of the cephalic end of the cut vagus causes glucosuria. This points to a control of carbohydrate metabolism in the central nervous system. The adrenals, if concerned in this at all, must play a minor part. H. G.

**The antitrypsin in blood and its transformation under different conditions.** S. TACHIGARA. *Mitt. med. Fak. Univ. Tokyo* 21, 437-506(1919); *Physiol. Abstracts* 5, 178.—The antitryptic power of rabbit serum was detd. by the Fuld-Cross method. A few expts. were also tried with sera from other animals. The values were unaltered on the induction of anemia by bleeding, saponin, and splenectomy, but were increased to 3 times the normal by picric acid injection. Complete nephrectomy raised the antitryptic power and also the residual N of the blood (as would be expected). Injection of organisms of the typhoid group also raised the power. Starvation, injection of NaCl, trypsin, and of egg-white were without effect. Antitrypsin is more resistant to temp. and drugs than trypsin. Lipoid-protein combinations appear to have no connection with the effect; the antitrypsin appears to be a product of protein breakdown, and not a sp. antibody. H. G.

**Influence of six-hour day on efficiency and fatigue.** H. M. VERNON. *Fatigue and village meeting halls.* C. SMITH-ROSSIE. *Measurement by carbon dioxide of energy output.* A. D. WALLER. *Brit. Assoc. Repts.* 1919, 308-13; *Physiol. Abstracts* 5, 213.—A series of papers related to an important practical use of physiol. data. H. G.

**Striped muscle structure.** VII. H. E. JORDAN. *Anal. Record* 19, No. 2(1920); *Physiol. Abstracts* 5, 219.—The structure of the sarcomere of the wasp's wing muscle furnishes the basis for an attempt to formulate a consistent physico-chem. explanation of *muscle contraction*. The extremely minute constituent metafibrils of this sarcostyle exhibit exactly the same fundamental structural changes during contraction as does the voluntary striped muscle fiber as a whole. The essential change during contraction concerns the equal division at the level of the mesophragma of the deeply staining substance of the Q-disk, and the movement of the resulting halves in opposite directions against the terminal telophragmata of the sarcomere, where are formed the contraction bands. The cause of muscular contraction is located in this movement of crystalloids among the colloidal particles (submicrons) of the terminal clear segments. The shortening and thickening of the sarcomeres in contraction is interpreted as the result of a change in shape of the intrafibril colloidal particles from ellipsoidal to spherical form,



due to an increase of their surface tension resulting from a decrease of their surface elec. charges, following the passage of electrolytes among them during the movement of the deeply staining substance from the mesophragma to the telophragmata. H. G.

**The respiratory exchange of man during and after muscular exercise.** J. M. H. CAMPBELL, C. G. DOUGLAS AND F. G. HOBSON. *Phil. Trans. Roy. Soc.* 210B, 1-47 (1920); *Physiol. Abstracts* 5, 232-3.—A simple method is described which enables a practically continuous record to be obtained of the respiratory exchange and hyperpnea during and after muscular work on a stationary ergometer. It is possible by this means to get a considerable amt. of information regarding rapid and transitory variations in the respiratory exchange. The efficiency of the body detd. by this method agrees closely with the results obtained by other observers. Evidence is given in favor of the view that muscular work not infrequently involves the metabolism of a higher proportion of carbohydrate to fat than occurs during rest. With the harder degrees of work the course of events is liable to be influenced by the effects of serious shortage of O as indicated by the production of lactic acid, which leads to a temporary, great exaggeration of the hyperpnea, accompanied by washing out of preformed CO<sub>2</sub> from the body and an abnormally high respiratory quotient. The exptl. data are not sufficient to exclude the possibility of the action of a slight degree of O deficiency (possibly a "direct" action of the respiratory center) in the lighter degrees of work in which there is no definite evidence of the production of lactic acid. After the stoppage of work the respiratory exchange and hyperpnea diminish with great rapidity. The respiratory quotient shows an immediate, but quite temporary, sharp rise, and it is suggested that this is due largely to the expulsion of CO<sub>2</sub> dammed in the body during muscular work owing to the alveolar CO<sub>2</sub> pressure being above the threshold stimulating value for the respiratory center which prevails just after the cessation of the work, though the effect may be exaggerated by the simultaneous action of the lactic acid. After this the respiratory quotient may return to the same value that it had previous to the muscular work, or it may show a marked diminution indicative of a retention of CO<sub>2</sub> to make up for the preformed CO<sub>2</sub> washed out of the body at an earlier stage, or of a true change in the tissue metabolism dependent on the depletion of carbohydrate during the work. H. G.

**The parathyroids.** H. BERGSTRAND. *Nord. med. Arkiv.* 53, 791-856(1920); *Physiol. Abstracts* 5, 247.—Mainly anatomical. The Bielschowsky method of staining is recommended for parathyroid tissue. Only 1 cellular type of functional value was found. Welsh's cell is a degeneration product. Colloid material was found, which is either a true secretion or a product of the breakdown of the Welsh cell. H. G.

**The alkali reserve of the blood of certain of the lower vertebrates.** J. B. COLLIP. Univ. Alberta. *J. Biol. Chem.* 46, 57-9(1921); cf. *C. A.* 15, 1764.—The CO<sub>2</sub> content and combining power of whole blood and blood plasma of the pigeon, duck, goose, turkey, hen, prairie chicken, mallard, hawk, guinea fowl, turtle, and frog were estd. using the Van Slyke app. The alk. reserve varied from 35.6 vols. % in the pigeon to 89.3 vols. % in the turtle so that there is a considerable variation in different species and in different members of the same species. A great decrease occurs in the alk. reserve of frog's blood following submersion. An acid-base transfer between the red cells and the plasma with varying CO<sub>2</sub> tension occurs in the blood of the lower vertebrates. The acid-base exchange between the plasma and the red blood cells. *Ibid* 61-72. Oxalated or defibrinated whole blood was equilibrated with CO<sub>2</sub> at different tensions. The plasma or serum was sepd. from the cells by centrifuging and then exposed to CO<sub>2</sub> at various tensions. The CO<sub>2</sub>-combining power was detd. by the Van Slyke method. In some expts. the method of ashing a definite amt. of serum, blood, or cells and detg. the CO<sub>2</sub>-combining power of the soln. of the ash was also employed. A very considerable transfer of acid and basic radicals or ions between the plasma or serum and the red

blood cells was observed on varying the  $\text{CO}_2$  tension and the results indicate that the change in  $\text{CO}_2$ -combining power is due to an actual migration of alkali from serum to cells when the whole blood is exposed to a low tension of  $\text{CO}_2$ . As the  $\text{CO}_2$  tensions were far from physiol. limits, it is quite possible that the results are not directly applicable to the blood of the intact animal. A part of the alkali of the blood is evidently combined with an org. substance functioning as a weak acid (protein for the most part) since the soln. of the ash of serum or of whole blood has a greater  $\text{CO}_2$ -combining power than the original serum or blood. The proteins of the blood compete with the  $\text{H}_2\text{CO}_3$  for the available base.  $\text{NaHCO}_3$  rather than  $\text{CO}_2$  combinations with proteins is the transporting vehicle for  $\text{CO}_2$  in the body. Although the total available alkali of serum is increased by exposing whole blood to an increased  $\text{CO}_2$  tension, the ionic concn. of the serum is practically unaffected since there is no appreciable change produced in elec. cond. of serum from whole blood treated with  $\text{CO}_2$  at a high tension. Samples of turtle, hen, turkey, ox, dog, sheep, and rabbit blood were examd. and it was possible to demonstrate the acid-base transfer between red cells and plasma of the blood of the lower as well as of the higher vertebrates.

A. P. LOTHROP

**Factors governing the excretion rate of urea.** J. HAROLD AUSTIN, EDGAR STILLMAN AND DONALD D. VAN SLYKE. Rockefeller Inst. *J. Biol. Chem.* **46**, 91–112(1921).—"The rate of urea excretion per unit of body wt. in a normal dog or man increases approx. (a) in simple direct proportion to the blood urea concn., and (b) in proportion to the sq. root of the rate of vol. output of urine per unit of body wt., as long as the vol. rate remains within ordinary limits. The increase in rate of urea excretion with vol. output of urine holds, however, only up to a certain limit of vol. output. This 'augmentation limit' varied in different normal individuals between 2.5 and 6 l. per 24 hr. time unit. Beyond this limit, rise of urine vol. does not further accelerate urea excretion. That an augmentation limit exists not only in vol. output of urine, but also in blood urea concn. is indicated by the results of Addis, who found that after the blood urea in rabbits reached 2.5 g. per l. further increase no longer accelerated excretion. Unlike the augmentation limit of urine vol. excretion, however, that of blood urea concn. lies at a height so greatly above that ever approximated in normal individuals that it may be neglected in formulating naturally occurring relationships. The observed relationships are expressed in the equation

$$D/W = KB \sqrt{(V/W)} \text{ or } K = D/B\sqrt{VW} = 7.5 \pm 3$$

(for normal man),  $D$  being the urea output (g. per 24 hr. time unit),  $B$  the blood urea (g. per l.),  $V$  the vol. output (l. per 24 hr. time unit),  $W$  the body wt. (kg.), and  $K$  the excretory const. For values of  $V$  above the augmentation limit, the value of the augmentation limit  $A$  replaces  $V$  in the formula. Values of  $K$  below the minimum normal limit of 4.5 indicate that for the blood urea concn., urine vol. output, and body wt. of the individual, urea excretion is abnormally slow. Ambard's first law,  $\frac{D}{B\sqrt{V}} = K$

when  $C$  is const., is a special case of the above equation. His second law,  $D\sqrt{C} = K$  when  $B$  is const. is inconsistent with the above formula. The greater constancy of results calcd. by the equation developed indicates the probability that it expresses the influence of the chief factors governing excretion with a closer degree of accuracy than does Ambard's equation. The use of a creatinine ratio rather than a time ratio is advocated when, because of retention in the bladder or other factors, the accuracy with which the time intervals of the collection period can be measured is doubtful. The calcn. based on the creatinine ratio is made as follows:  $V = (\text{g. creatinine excreted per 24 hrs.})/(\text{g. creatinine per l. in sample of urine secured})$  and  $D = V \times \text{g. urea per l. of urine}$ . The physiol. studies presented afford a basis for detecting abnormalities in urea excretion, but not for interpreting the significance of such

abnormalities." Studies of a sufficient number of patients under the most complete and prolonged clinical observation must be made before attempting to interpret abnormal variations. Until such studies have been completed, the functional index must be regarded as an object of investigation, rather than as an aid in the clinic.

A. P. LOTHROP

The acidity of goat milk in terms of hydrogen-ion concentration, with comparisons to that of cow and human milk. E. W. SCHULTZ AND L. R. CHANDLER. Stanford Univ. *J. Biol. Chem.* **46**, 129-31(1921).—"The av. H-ion concn. of fresh goat milk (160 detns.) is 6.53; that of completely soured milk (73 samples) 3.92. Fresh goat milk is therefore slightly more acid than fresh cow milk, (6.5-6.76) and appreciably more acid than human breast milk (6.86-7.46). Soured goat milk is considerably more acid than soured cow milk (4.65)." The size of fat globules in goat milk. *Ibid* 133-4. Goat milk rarely forms a cream layer although the % of fat is practically the same as that of cow milk. In cow milk 90% of the fat globules are over 4 microns while in goat milk 91% are under 4 microns and over half of these are under 2 microns. The globules in human milk are said to be even larger than those in cow milk. "With the quantity of fat practically the same, it becomes obvious that the fat in goat milk, being more highly dispersed, possesses an enormously greater surface area than does that of either cow or human milk. It should, therefore, be considerably more accessible to the lipase of the digestive juices, and consequently more rapidly and completely digested."

A. P. LOTHROP

Chemical nature of tissue coagulins. C. A. MILLS. Univ. Cincinnati. *J. Biol. Chem.* **46**, 135-65(1921).—"The phospholipins to be extd. from tissues possess only a very small part of the total activity of the tissue material on the clotting of blood. The active principle of tissue exts. is, in part, protein in nature, so that any treatment that removes the proteins from soln. or alters them in any way destroys or greatly reduces the activity of the material. The protein nature of the compd. must be considered in its purification, if its activity is to be retained. The isoelec. point of the compd. lies between  $N \times 10^{-3}$  and  $N \times 10^{-4}$  acidity. At this point the material ppts. from its solns. without loss of its activity on coagulation. This fact is made use of in the isolation and purification of the active principle. The purified substance possesses the soly. characteristics of the globulin class of proteins and is heat-coagulable. It consists of about 41.6% of phospholipin and 58.4% of protein, the protein fraction containing about 1.06% of P. This P is apparently present as very stable phosphoprotein, since no purine bases were found after thorough hydrolysis of the protein by acid. That the P is very firmly combined in the phosphoprotein is evident from the fact that several hrs. boiling with 5% alkali fails to split off more than a small part of it. The activity on blood coagulation depends on the union of the phospholipin and protein fractions. Sepn. of the two parts as completely as can be by extn. at room temp. with fat solvents, leaves each with only a very small part of the original activity. Reunion of these two fractions restores the greater part of this activity. Addition of further amts. of phospholipins to the active material as it exists in the lungs increases its activity about fourfold. It is therefore evident that the % of phospholipin united to the protein fraction is a very important factor in the production of the activity. This further activation of tissue exts. should be of considerable practical importance, since it is possible to get a soln. fully 16 times as strong in activity as the best of those at present on the market, and about 1,000 times as strong as many that have been widely used. The presence in the tissues of an actual union between the protein and phospholipin elements is clearly shown. It is also shown that any alteration in this relation causes a great change in the sp. activity of the compd. This fact may afford a future basis for working out the reasons for many cell reactions, especially reactions to any fat-solvent materials." Exts. of lung tissue (dog, rabbit, beef) were used in the expts. since lung tissue has been

found to contain much more of the active material than any other tissue of the body. The material is readily sol. in dil. NaCl soln. and was extd. from powdered lung, dried in an air current at room temp., 4 cc. of 0.9% NaCl soln. per g. of dried tissue being used. It is completely pptd. by half satg. the NaCl soln. with  $(\text{NH}_4)_2\text{SO}_4$  or complete satn. with NaCl or  $\text{MgSO}_4$ . The protein fraction is probably of a definite and sp. nature since very similar globulins, such as those from liver, did not form active compds. when shaken with the phospholipin freshly extd. from dried lungs. The phospholipin is probably all cephalin. The purified material (or ext. activated by addition of further phospholipin) should be a very valuable substance for controlling local hemorrhages, in both surgical and accidental cases. Its use in cases of hemophilia has not yet been investigated. The expts. confirm the conclusion of Wooldridge, stated 35 years ago, that the active agent of tissue exts. is a proteinphospholipin compd. The action of tissue extracts in the coagulation of blood. *Ibid* 167-92.—"Tissue exts. accelerate the clotting of blood in a very definite manner, the coagulation time of the blood increasing from a minimum of about 10 secs. up to the normal time as the tissue ext. is dild. The log of the coagulation time in secs. plotted against the log of the diln. of the ext. gives almost a straight line. It is possible to get a noticeable quickening of the clotting process with the active tissue substance added to plasma in the proportion of 1 part of active substance to 100,000,000 parts of plasma. The active tissue substance will not react with the blood fibrinogen to form fibrin, either *in vitro* or *in vivo*, except in the presence of sol. Ca salts. Injected intravenously, rapidly, and in sufficient amts., tissue exts., or the purified active substance, cause intravascular clotting and death in a very definite manner. Injected slowly and in smaller amts. the blood is rendered non-coagulable, partially or completely, the non-coagulability apparently depending on a gradual removal of the greater part of the fibrinogen from the blood stream. A marked decrease in the alk. reserve of the plasma develops along with the development of the negative phase of coagulation, but is apparently not the cause of it. The injection of active tissue exts. into the blood stream so as to produce non-coagulability without clot formation is followed by an excretion of the active tissue substance apparently unchanged in the urine (dogs and rabbits). As observed by Loeb, there is present a class specificity in regard to the action of the tissue exts. on blood clotting. The specificity, however, is not abs., since mammalian lung ext. will accelerate the clotting of frog blood *in vitro*. There is a latent period in the coagulation process which is remarkably const. under similar conditions. Upon this depended the success of showing accurately the result of diln. of the tissue exts. upon their coagulative action. But it may be demonstrated also for intravascular clotting of the blood. Thus, after the injection of a fatal dose of lung ext. into the ear vein of a rabbit, the time that elapsed before the onset of the convulsive struggles did not vary more than 10 secs. in different rabbits, being 15-20 secs. after the injection. This gave time for at least a partial distribution of the active substance through the blood with the resulting greater diln. of it. Just as plasma *in vitro* cannot be made to clot much quicker than 10 secs., regardless of the concn. of the tissue material, so it was also found to be with the blood in the vessels. Always if coagulation occurred in any degree in the vessels following tissue ext. injection, it occurred within 30 secs. after the injection. If the amt. injected was not sufficient to give results in that time, then no solid clots formed, but a negative phase of coagulation set in. Further injections into the same animal of like or gradually increasing amts., only served to increase the negative phase, until finally the blood was totally non-coagulable. The diminution or lack of fibrinogen in such blood appears to be the cause of its non-coagulability." A. P. LOTHROP

Blood bicarbonate levels following administration of sodium bicarbonate. STANLEY P. REIMANN AND HOBART A. REIMANN. Univ. Penn. *J. Biol. Chem.* 46, 493-8(1921). —When  $\text{NaHCO}_3$  is administered by mouth to normal individuals, the observed increase

in blood bicarbonate agrees very closely with the theoretical increase calcd. by Palmer and Van Slyke's formula (C. A. 12, 387). The deviation of observed from calcd. values in various diseases is greater than in normal persons. When  $\text{NaHCO}_3$  is injected intravenously into normal dogs, the form of the curve showing the rise in blood bicarbonate is not a straight line. It is pulled downward and to the right, indicating that some of the  $\text{NaHCO}_3$  escapes from the blood as it enters the vein. The concn. in the blood falls abruptly but does not return to near the starting point until about 1 hr. after the administration. Comparison of blood and lymph bicarbonate after intravenous injection of sodium bicarbonate. STANLEY P. REIMANN AND M. D. SAUTER. *Ibid* 499-502.—After intravenous injection of 4%  $\text{NaHCO}_3$  soln., parallel increases in blood and lymph bicarbonate were observed. The passage from blood to lymph occurred at a remarkably rapid rate. This passage of bicarbonate into lymph and tissue spaces was responsible for the form of the curve obtained as mentioned above. A. P. LOTHROP

Hydrogen-ion concentration of the contents of the small intestine. J. F. McCLENDON. Univ. Minn. Med. School. *Proc. Nat. Acad. Sci.* 6, 690-1(1920).—The intestinal contents were removed through a tube 7 ft. long which was swallowed by the subjects under investigation and kept down without inconvenience by two subjects for 5 days and 4 nights. The position of the tube in the digestive tract was ascertained by means of the fluoroscope. It required 5 days for the tube to descend its full length. Samples of the intestinal contents could be obtained only when digested food was descending from the stomach; at other times practically no fluid could be obtained. The H-ion concn. became less as the tube descended farther into the small intestine; the first day the concn. was  $10^{-4.7}$ , 2nd day  $10^{-5}$ , 4th day  $10^{-5.1}$ , 5th day  $10^{-6.2}$ . The intestinal contents, incubated at body temp., showed hardly any proteolytic action on coagulated egg-white. "Probably egg-white requires to be swollen by the acid in the stomach before rapid proteolysis can take place." Thus the contents of the human small intestine were not found to be alk. as is generally supposed. The detns. of H-ion concn. were made with the H electrode. M. states that the acidity of the intestine aids in the preservation of the antiscorbutic vitamine while it is being absorbed. The feeding of lactose changes the intestines of guinea pigs from alk. to acid. C. H. R.

Formation of urea in the liver after death. R. FOSSE AND MISS N. ROUCHELMAN. *Compt. rend.* 172, 771-2(1921).—The liver of a dog, thoroughly bled, was ground to a pulp and approx. 20 g. portions were placed in tared flasks and the exact wt. was detd.,  $\text{CHCl}_3$  was added in equal amts. to each flask, the contents were mixed, the flasks corked and allowed to stand at ordinary temp. After autolysis and dealbumination had ceased as detd. by Tarnet's reagent containing a double portion of iodo-mercurate to that used in testing blood, the contents of the flasks were centrifuged and filtered so that a given vol. of the filtrate corresponded to the same wt. of liver. One vol. of  $\text{AcOH}$  was added to 1 vol. of the filtrate and 1 g. of xanthidrol (dissolved at the moment of the test in 10 g.  $\text{AcOH}$ ) was added for each 200 cc. of the mixt. Urea, detd. as xanthylurea, was 6 times as great after autolysis as in the control. The test was repeated with fluoride as antiseptic instead of  $\text{CHCl}_3$  with the av. results nearly the same. With cooked liver the amt. of xanthylurea averaged about 0.2 that of raw liver. L. W. RIGGS

Physiologic properties of the nucleic acids of lymphatic ganglions and of the thymus. Conditions for obtaining a thymo-nucleic acid very active on the blood. DOYON. *Compt. rend.* 172, 820-1(1921).—Lymphatic ganglions from beef mesentery furnish a convenient source of the active acid, which is prepd. by the method of Neuman. The yield is above 1% and the acid contains 9.5 to 10.5% of P. Following the usual procedure, 0.1 g. of the acid in 5 cc. of a soln. containing  $\text{NaCl}$  4 g.,  $\text{Na}_2\text{CO}_3$  5, and  $\text{H}_2\text{O}$  1000, mixed with 20 g. of dog's blood taken directly from the carotid into a tared tube placed on a balance pan, then centrifuged at high speed, yields a stable colorless plasma. This plasma is not coagulated by either serum or  $\text{CaCl}_2$  alone but coagulates in 2 to

8 hrs. after the addition of both serum and  $\text{CaCl}_2$ . The soln. of nucleic acid may be kept in the presence of thymus for several weeks and perhaps indefinitely without losing its physiol. properties. The yield of nucleic acid from the calf's thymus is higher than that from other organs, yet the acid obtained by the method of Neuman is relatively little active. To insure obtaining an active acid it is necessary before applying the method of Neuman to allow the gland to putrefy. The gland is hashed, water added, and placed in a thermostat 15 to 18 hrs. The yield is slightly below 1% and diminishes if the putrefaction is prolonged beyond the time indicated. L. W. RIGGS

**Catalytic properties of the respiratory metals.** JOHN F. FULTON, JR. *Science* **53**, 444-6(1921).—A brief review is given of the work of Alsberg and Clark, Griffiths, Hecht and others upon the relations of Mn, Cu, Fe and V in the blood pigments to respiratory processes. The absence of metals in some respiratory pigments appears to indicate that the function of oxygenation is not dependent upon the presence of the metal, but that the presence of the metal, acting as a catalyst, increased the capacity for ready oxidation and reduction. L. W. RIGGS

**Transformation of energy in the muscle. I. Relation of lactic acid to the heat production and to the performance of work in the muscle in anaerobiosis.** OTTO MEYERHOF. *Arch. ges. Physiol. (Pflüger's)* **182**, 232-83(1920).—The amt. of lactic acid formed in muscle under various conditions was detd. Muscles made rigid with  $\text{CHCl}_3$  yielded 0.4-0.59%; under max. fatigue due to tetany the yield was 0.152-0.243%; under the application of repeated stimuli (60 per min.) 0.388% was found. Variation in the amt. was associated with the temp. (tetanic fatigue at 22 gave 0.210%, at 14, 0.17%), and with the time of year (Sept. 0.24%, Feb. 0.16%). The yield also paralleled the fatigue max. Higher values were obtained after isometric than after isotonic contraction. Detns. of the caloric quotient—g.-cal. per 1 g. of lactic acid—showed the following values: in muscles made rigid with  $\text{CHCl}_3$ , 340 cal.; in tetanic fatigue, at 7.5° 470 cal.; at 14°, 435 cal.; at 22°, 390 cal.; after individual stimuli, 352 cal. In anaerobiosis the caloric quotient was 280. It is estd. that about 150-200 cal. are associated with chem. activity, and the remainder of the caloric quotient is due to physical processes. The medium under which isometric contraction is accomplished has but little influence upon the ratio between isometric work and lactic acid formation. II. **Fate of lactic acid during the recovery of the muscle.** *Ibid* 284-317.—During the period of the recovery of the muscle the accumulated lactic acid completely disappears with the simultaneous utilization of  $\text{O}_2$ , which, in spite of individual variations, is always about  $1/2-1/4$  as much as is necessary for the combustion of the lactic acid. The ratio,  $\text{O}_2$ :lactic acid, is always maintained and is const. whether fatigue is due to tetany or to repeated stimuli, or whether fatigue is complete or partial. In anaerobiosis much more lactic acid is formed than corresponds to the  $\text{O}_2$  used in the same time under aerobic conditions. Thus, lactic acid formation here may be considered as an "anaerobic intramolecular respiration." Values secured experimentally for the disappearance of lactic acid, the utilization of  $\text{O}_2$ , and the caloric quotients suggest that respiration during rest and the oxidation occurring during muscular activity are to be considered as identical processes. Accepting hexosediphosphoric acid as the precursor of lactic acid these processes may proceed thus: (I) hexosediphosphoric acid +  $2\text{H}_2\text{O} = 2$  lactic acid + 2 phosphoric acid; (II) 3 lactic acid + 2 phosphoric acid +  $3\text{O}_2 = 3\text{CO}_2 + 5\text{H}_2\text{O} + 1$  hexosediphosphoric acid. G. H. S.

**Effect of experimentally induced hypoactivity of one or more endocrine glands upon growth processes in young cats and dogs.** A. PUGLIERE. *Arch. ital. biol.* **70**, No. 10, 1-34(1920).—When subjected to the removal of one adrenal and the thyroid adult cats and dogs continue in undisturbed well-being and procreate and raise young in a normal manner. Additional removal of the spleen is without effect. Unilateral thyreo-parathyroidectomy in young animals causes increase in wt., this effect is neutral-

ized by the removal of an adrenal. The simultaneous excision of thyroid tissue and an adrenal impairs the development of young animals. This loss is particularly marked in bone development, and chem. analyses show a deficiency of 1.6% in N, an excess of 6.64% in ash, a 3.28% excess of CaO and 2.87% more  $P_2O_5$ . The degree of change from normal conforms somewhat to the duration of life (84-104 days) after the operative procedure. Associated with the bone changes there is a marked reduction in body fat. Cats subjected to such procedure show hypertrophy of the remaining thyroid tissue, the adrenal, and the hypophysis. These results are not modified by splenectomy. Similar expts. upon dogs showed less marked changes.

G. H. S.

**Effect of different mechanical conditions on muscular contractions.** G. GALBOTTI. *Arch. ital. biol.* 70, No. 10, 115-49 (1920).—The isolated frog gastrocnemius was examd. under different conditions of contraction and detns. were made of the caloric exchange, respiratory exchange, and acid production. The amt. of heat developed during isometric contractions (55.3 microcalories) was greater than that during effective work (39 microcal.). Although heat production is apparently the same in isometric and in isotonic contraction the amt. actually developed within the muscle by chem. processes is greater in isometric activity. Heat production during tetany is highly variable, the amt. depending upon diverse conditions. When at rest the  $O_2$  consumption amounts to 0.00079 (av.) g. of muscle per min. During contraction this is increased about 4 times (isometric, 0.0029; isotonic, 0.0032; during effective work, 0.0025; in tetany, 0.0019-0.0020). During the period following the contraction the degree of  $O_2$  consumption varies with the type of contraction which was employed. The H-ion changes (acidity) increase whatever the type of contraction. At rest the H-ion concn. =  $16 \times 10^{-8}$  g.-ion per l. After effective work this value is increased 6.1 times; after isometric contractions, 5.5 times; after isotonic contractions, 1.7 times; and after isotonic tetany, 2.8 times. Under conditions of effective work in which the muscle relaxes spontaneously less heat is developed,  $O_2$  consumption is low, and acid production is maximal. In isotonic contraction heat production is high,  $O_2$  consumption is relatively great, and acid production is very low. High values for all 3 factors are found in isometric contraction. In tetany heat production is variable, and  $O_2$  consumption and acid production are not excessive.

G. H. S.

**LESCHKE, ERICH: Wechselseitige Beziehungen der Drüsen mit innerer Sekretion.** Halle: Marhold. 48 pp. M 3. For review see *Deut. med. Wochschr.* 47, 604 (1921).

## G—PATHOLOGY

H. GIDEON WELLS

**The pellagra outbreak in Egypt.** JOS. GOLDBERGER. U. S. Pub. Health Service. *Lancet* 1920, II, 41-2.—G. attempts to show that the claims of J. I. Enright (cf. *C. A.* 14, 2023) and Viswalingam (*J. Trop. Med.* 23, p. 46 (1920)) that the food deficiency theory of the causation of pellagra has been exploded, are based upon insufficient evidence, in that it cannot be assumed in the case of war prisoners, that the diet furnished although adequate, was consumed, because of racial differences in methods of prep'n., seasoning, etc. A. D. Bigland's (cf. *C. A.* 14, 1144) "toxin hypothesis" appears to be superfluous on the same grounds.

E. B. FINK

**Glucemia and glucosuria.** (II), (III). GEORGE GRAHAM. *Lancet* 1921, I, 1003-7, 1050-65; cf. *C. A.* 15, 2121.—These articles constitute the 3 Goulstonian Lectures for 1921, and consist largely of a review of recent progress in the study of diabetes with some reference to the writer's personal clinical experience.

E. B. F.

**Experimental rickets.** J. KOCH. *Arch. wiss. prakt. Tierheilkunde* 45, 263-326 (1919); *Physiol. Abstracts* 5, 254.—The main conclusion is that true rickets is the result of streptococcal infection.

E. H.

**Oxygen avidity of normal and malignant cells.** A. H. DREW. *Brit. J. Exptl. Path.*





shift toward the alk. side during growth if sugar-free broth is used. The maximal toxin production depends not only on the amt. of growth but on the time of incubation and the initial and final  $p_H$ . The initial  $p_H$  should be 7.3 to 7.4 and the final, 8 to 8.3. Eight days incubation is best. If the initial  $p_H$  is lower a longer incubation period is required to produce the same amt. of toxin. JOHN T. MYERS

## H—PHARMACOLOGY

ALFRED N. RICHARDS

Investigations in the colchicine series. H. LIPPS. *Arch. exp. Path. Pharm.* **85**, 235–55(1920); *Physiol. Abstracts* **5**, 252.—Colchicine is regarded as a capillary poison, and details of its action in frogs and cats are given for it and many of its derivs. E. H.

Habituation of the psychic functions to caffeine. T. WEDDEMAYER. *Arch. exp. Path. Pharm.* **85**, 339–58(1920); *Physiol. Abstracts* **5**, 252.—By giving 6–10 g. of caffeine in the course of 4–5 weeks there is a measurable weakening of the action of the drug on psychic processes. E. H.

Histamine shock. H. H. DALE. *Brit. J. Exptl. Path.* **1**, 103–14(1920); *Physiol. Abstracts* **5**, 147; cf. Dale and Laidlaw, *C. A.* **13**, 2405.—While the similarity of the shock produced by trauma and by histamine is very great, the actual production of histamine in a tissue by injury is only at present an open possibility. Its action, however, is typical of a group of poisons of animal or bacterial origin, and the substance is a convenient one for the quant. production of the effect. The important consideration is now pointed out that the effect is largely dependent on and influenced by other factors. A normal cat can stand doses of 10 mg. per kg. intravenously without any severe or lasting effect, but the resistance is lowered by ether anesthesia, by moderate hemorrhage, and especially by removal of the adrenals. E. H.

Action of hypophysin (Parke Davis's pituitrin) on the rabbit pupil. W. B. I. POLLOCK. *Brit. J. Ophthalmol.* **4**, 106–24(1920); *Physiol. Abstracts* **5**, 248.—When hypophysin was instilled into the eye, midriasis occurred in 94% of the cases; this effect is increased by "decentralization," and still more by "deganglionation," of either the sphincter pupillae or the dilator iridis, or better still of both. When it is given intravenously, the local effect may be overlooked if counteracted by a rise of blood pressure or excitation of the 3rd nerve. If that nerve is cut, dilatation of the pupil by pituitrin (intravenously) is marked and immediate. It is considered that the drug, like adrenaline, acts on the myoneural junction. E. H.

Contribution to the knowledge of the fate of morphine in animal organisms. I. K. TAMURA. *Mitt. med. Fak. Univ. Tokyo* **22**, 121–63(1919); *Physiol. Abstracts* **5**, 195.—The observations of Guigan and Ross, that the injection of morphine some time previously hastens the onset of strychnine tetanus in frogs and that the oxidation product of morphine by  $HNO_3$  will generate tetanus more quickly than morphine, are confirmed. From the mixt. resulting from the action of strong  $HNO_3$  on morphine, the convulsant substance was isolated and found to be 2-nitrosomorphine. When this substance was prepd. in the pure state by the action of  $HNO_3$  on morphine, it was found to have exactly the same action. By further action of  $HNO_3$  on this, an amorphous substance with similar properties was obtained, though by prolonged action an inert body resulted. The oxidation product morphinequinol is almost inactive. It is assumed that substances related to some of these oxidation products are formed slowly *in vivo*, and that the slow appearance of convulsant properties is due to this. E. H.

"Salbrantin:" Intra-organic behavior of halogenated aromatic compounds. EDUARDO FILIPPI. *Arch. farm. sper.* **30**, 113–26(1920).—The results of F.'s expts. are as follows: 3,5-Dibromosalicylic acid, m.  $223^\circ$ , is rapidly and completely destroyed either *in vivo* or *in vitro*, this ready decompn. being attributed to the presence in the mol. of a Br atom in the  $p$ -position to the hydroxyl group. Similar behavior is exhibited by 5-

chloro-3-iodosalicylic acid, m.  $224^{\circ}$ , whereas 3,5-diiodosalicylic acid gives up its halogen with some readiness, but is not completely destroyed. "Salbrantin" gives up its Br with the same rapidity and ease as 3,5-dibromosalicylic acid, and may, therefore, be regarded pharmacologically as a true brominated antipyrine, and not as a salicylic deriv. J. C. S.

**Rhythmic contractions in surviving arteries.** G. APITZ. *Arch. exp. Path. Pharm.* **85**, 256-70(1920).—Strips of the carotid artery of the horse show rhythmic waves of contraction when suspended in a bath of Ringer soln., provided  $\text{NaHCO}_3$  is present in a concn. of 0.04%. The tissue is inert if less  $\text{NaHCO}_3$  is present, but subsequent addition to the necessary percentage permits activity. For observing contraction with such tissue the soln. advocated has the following formula:  $\text{NaCl}$  6.5,  $\text{KCl}$  0.2,  $\text{CaCl}_2$  0.2,  $\text{NaHCO}_3$  0.4,  $\text{H}_2\text{O}$  1000. The passage of  $\text{O}_2$  through the bath is not essential, but it favors the duration, intensity, and regularity of the contractions. The tissues show greater activity if they are subjected to a preliminary tension. The character of the contractions secured with different preps. varies somewhat. G. H. S.

**Electrolytes of Ringer solution.** G. PIETRKOWSKI. *Arch. exp. Path. Pharm.* **85**, 300-18(1920).—Both agar and gelatin act like living cells to the electrolytes of Ringer soln. The chlorides of the alkali metals and alk. earths cause swelling in the series  $\text{K} < \text{Na} < \text{Ca}$ ,  $\text{Mg}$ . The effect of Ca-free Ringer soln. upon the heart is ascribed to a mechanical action upon the muscle, the result of a surface swelling of the fibers which interferes with the physiol. changes in surface tension. Ringer soln. deprived of K has an opposite effect—a reduction in the surface of the fibers. Other substances which increase tonus (Ba, methyl violet, digitalis) react in the same way upon the colloidal systems. G. H. S.

**Tolerance to poisons. II. Dye fastness of protozoa.** S. M. NEUSCHLOZ. *Arch. ges. Physiol. (Pflüger's)* **178**, 61-8(1920).—The tolerance of parametia to dyes of the thiazine, benzidine, and triphenylmethane series (methylene blue, trypan blue, and fuchsin) was detd. Upon normal parametia these dyes exert a toxicity of the following degrees: methylene blue 1:8,000 killed in 1 hr. 18 min., trypan blue 1:80,000 in 1 hr. 16 min., fuchsin 1:16,000 in 1 hr. 18 min. Continued cultivation of the organisms in increasing concns. of the dyes showed that a tolerance amounting to from 25 to 440% could be obtained. The development of tolerance was associated with an increased ability of the organisms to destroy the dye and to reduce it to colorless non-toxic compds. (III) The nature of arsenic and antimony fastness of protozoa. *Ibid* 69-79.—Parametia were cultivated in increasing concns. of  $\text{NaAsO}_2$  and  $\text{KSbO}(\text{C}_2\text{H}_3\text{O}_4)$  and their tolerance to these compds. was compared with that of normal organisms. A considerable tolerance was developed, which was not strictly sp. since As-tolerant parametia are also more resistant to Sb. They do not, however, show increased resistance to dyes. The acquisition of tolerance to As and Sb is ascribed to the development of an ability to convert toxic trivalent forms of these chemicals into non-toxic pentavalent forms. G. H. S.

Mercury dibutyl and some of its derivatives (TIFFENEAU) 10.

## I—ZOOLOGY

R. A. GORTNER

**The part played during incubation by the glucose injected into the protein of hen eggs.** MASAJI TOMITA. *Biochem. Z.* **116**, 22-7(1921).—T. detd. the amt. of glucose recoverable from the whites and yolks of eggs injected with measured amts. of glucose or alanine after incubation for 3 days, using as controls the amts. of glucose obtained from fresh eggs and eggs that had been incubated for 3 days. In the fresh eggs it was found that the white contained 0.47% and the yolk 0.24% glucose. In eggs which had been incubated for 3 days the values were 0.43% and 0.20%, a slight diminution. The eggs

treated with glucose showed a loss of this compd., while those treated with alanine showed no change.

F. S. HAMMETT

The formation of *d*-lactic acid during the autolysis of hen eggs. MASAJI TOMITA. *Biochem. Z.* 116, 28-39(1921).—This portion of the study showed that the amt. of *d*-lactic acid of the yolk of hen eggs first increases and then decreases on autolysis while that of the white remains apparently unchanged. This holds true when either glucose or alanine is added to the autolyzing mixt. The general conclusion drawn from this series of studies is that it can safely be stated that *d*-lactic acid is produced from glucose and apparently not from amino acids in the animal organism, although T. does not deny that the latter source may be genuine when the carbohydrate store is low. He is of the opinion that sugar is first formed from the protein and then lactic acid from the sugar. It is tentatively assumed that the lactic-acid-forming enzyme cannot diffuse through the yolk membrane, and that the ferment action takes place only in the yolk, using as a substrate the glucose already there and that which diffuses in when the original lot is changed to lactic acid, this latter then diffuses out into the white through the yolk membrane.

F. S. HAMMETT

Metabolism of amphibian larvae. J. K. PARNAS AND ZOFIA KRASINKA. *Biochem. Z.* 116, 108-37(1921).—Fertilized eggs of *Temporaria*, *Bufo* and *Esculenta* were used in this extensive study. As a rule they were maintained at temps. from 11° to 15°. It was found that eggs of *Bufo vulgaris* after fertilization showed an O<sub>2</sub> consumption of 0.42 cu. mm. per egg per hour at 14° in air, while unfertilized eggs used only 0.09 cu. mm. In an atm. of pure O<sub>2</sub> the ratio remains practically the same, although the abs. amts. are higher because of the satn. of the eggs with O<sub>2</sub>. Further detns. of the course of the O<sub>2</sub> consumption of embryos of 32 blastomeres up to the tadpole stage are recorded in many curves and tables. It is noted that when the O<sub>2</sub> partial pressure exceeds 150 mm. a marked influence upon the intensity of oxidation takes place while no marked effect is observed on velocity of development. Two periods during the development of the frog egg in which changes in the oxidation and the morphogenetic processes are marked. The first is at the border line between the blastula and the gastrula stages; during this period the ability to develop anaerobically ceases and the first rise in O<sub>2</sub> consumption occurs. The second lies at the beginning of the nerula and the change in outer form; at this time there occurs an increased O<sub>2</sub> consumption, which is particularly noticeable in an atm. of pure O<sub>2</sub>. Moreover, the sensitiveness towards cell narcotics such as urethan has its max. at the beginning of gastrula formation. These observations lead to the theory that blastula development is a preparatory stage for the new phase of oxidation metabolism, on which the processes of tissue formation depend and which are inhibited by lack of O<sub>2</sub>. These earlier processes seem to be particularly sensitive to narcotics, but when the oxidative mechanisms come into play the sensitiveness decreases. Detns. are also recorded which show that fat does not participate in the metabolism of the developing frog egg.

F. S. HAMMETT

The influence of specifically formed iodine compounds on the metamorphosis of frog larvae and of axolotl. J. ABELIN. *Biochem. Z.* 116, 138-64(1921).—Studies are reported of the influence of KI, NaI, NH<sub>4</sub>I, KIO<sub>3</sub>, Lugol's soln., diiodosalicylic acid, diiodophenyl salicylate, idopyrine, diiodotyrosine, diiododithymol, iodo-gallicin, iodized protein, noniodized proteins, and tyrosine on metamorphosis of tadpoles. The results showed that certain types of org. I<sub>2</sub> protein derivs. such as diiodotyrosine and iodized protein are of importance at the beginning, and during the course of frog larva metamorphosis, while the other compds. of non-protein nature are ineffective. The active compds. act as does the thyroid substance itself. Their activity is to be taken into account when thyroid exts. or thyroid decompn. products are used. Similar results were obtained with axolotl.

F. S. HAMMETT

Constituents of Japanese common earthworm. Y. MURAYAMA AND S. AOYAMA.

*J. Pharm. Soc. Japan* 469, 221-40(1921).—Analyses are reported of ether and alc. exts. of dried common earthworm, *Perichaeta communissima*, Goto and Hatai (Lumbricus Spencer). Com. dried worms sold in drug stores give about 2% of ether ext., which consists mainly of fatty oil. Its characteristics are:  $d_{15}$  0.9717, acid value 98.0, sapon. no. 115.9, I no. 73.6, Hohner no. 68.9, R. M. no. 3.9, and unsapon. matter 31.2%. Almost all of the unsapon. matter is cholesterol (m. 136-41). Both solid and liquid free fatty acids are present, the former being a mixt. of stearic and palmitic acids, the latter highly unsatd. fatty acid (63.7% of Br in the brominated acid). The fatty acids in the fat are identical with those present in the free state. The highly brominated fatty acid corresponds to either  $C_{15}H_{26}O_4Br_3$  or  $C_{18}H_{38}O_4Br_3$ , but its exact compn. could not be ascertained on account of impurity. The  $H_2O$ -sol. and  $Me_2O$ -insol. fraction of the alc. ext. of the worm contains leucine and a lipid (3.96% of P). From the  $H_2O$  ext. after removal of impurity by lead acetate tyrosine (m. 260) was isolated. The  $H_2O$  ext. of the fresh worm gave the same amino acids as the dried worms on the market.

S. T.

Effect of variations in oxygen tension on the toxicity of sodium chloride isotonic to sea water. ISAAC STARR, JR. *Biol. Bull.* 40, 134-42(1921).—The expts. were made with the larvae of the marine worm *Arenicola cristata*. When these animals are placed in pure NaCl soln. isotonic to sea water they at once contract to about two-thirds their former length and all motion ceases. A slow relaxation follows and eventually death. If replaced in sea water before death they slowly recover completely or to some extent. The larvae were collected in the lighted side of a culture dish, the water was tilted off and the last traces were removed with blotting paper. They were then washed twice with the exptl. soln. and transferred by means of a pipet to 50 cc. of that soln. At hourly intervals about 100 larvae were removed from the test soln. and replaced in sea water. These were inspected in 1 hr. and in most cases 12 hrs. after their return to sea water and the ratio of those in motion to those still was detd. Tests were made, 0.52 molecular NaCl being used in the absence of  $O_2$ , the soln., having been boiled while a stream of  $H_2$  was passing through it. A control soln. was also boiled but air instead of  $H_2$  passed through. Tests were made with increased  $O_2$  tension by passing  $O_2$  into the soln., tensions of 250, 275, 320, and 750 mm. being given. The results are assembled in 7 tables and the following conclusions stated: The removal of most of the  $O_2$  from the soln. markedly diminishes the toxicity of NaCl isotonic to sea water to *Arenicola* larvae. Slight increase in  $O_2$  tension also markedly diminishes the toxicity of isotonic NaCl. Satn. with  $O_2$  greatly increases the toxicity of this soln. At a tension of 275 mm. the toxic and antitoxic effects balance.

L. W. RIGGS

Studies of the biology of fresh-water mussels. WM. RAY ALLEN. *Biol. Bull.* 40, 210-40(1921).—Extensive expts. are recorded upon the food relations of certain *Unionidae*. A partial summary follows: Feeding in the Najades is nearly a constant function under normal conditions. The presence of much undigested and sometimes living matter in the rectum and feces shows that there is a greater fluctuation in the degree of digestion than in the rate of ingestion. Posture has no effect upon the continuity of the feeding process. The return of undigested material from the intestine through the style sac to the stomach is an unusual occurrence in the Najades; it takes place only after periods of starvation, and it is interrupted with the reformation of the style. It is a function much less significant in the Najades than in the tidal forms. Expts. in feeding relatively finer and coarser plankton show that both are capable at least of stimulating the renewal of the crystalline style. The studies of the intestinal contents of the Unionids have not shown what the actual food is, but rather the undigested residue. Organisms undigested in the feces are sometimes digested under another set of conditions. Starved animals fed in a creek below the outlet of a sewer showed in their intestinal contents many large org. fragments, abun-

dance of minute flagellates and large amts. of *Oscillatoria* filament. The regeneration of the style is in response to the ingestion of food, and not due to the physico-chem. character of the water. Flagellates and bacteria present are more responsible for the renewal of the style than are the bulkier ciliates. The reformation of the cryst. style is an index of the renewal of feeding activity. Low temps. hinder the formation of the style. The gills and palps exercise selection and keep out mud, sand and coarser material.

L. W. RIGGS

Reducing power of organic liquids and tissues of certain marine animals. RAOUL BAYRUX. *Compt. rend.* 172, 878-80(1921).—The method of H. Roger as applied to terrestrial animals was used in the study of *Scyllium catalus*, *Octopus vulgaris*, *Loligo vulgaris*, and *Strongylocentrotus lividus*. Equal wts. of hashed tissue and bicarbonated sea water were heated in a thermostat to 38°, a few drops of an aqueous soln. of methylene blue were added, agitated, allowed to stand and the time was observed in which the mixt. lost its blue color. This time is inversely proportional to the reducing activity of the tissue. In some cases when heated to 38° the reduction was too rapid to be measured by the time factor. The tests were made at 14°. Sperm and pancreas required 3.8 to 13 min., other parts 21 to 65 min., eggs 74 min. to 5 hrs., and pure vitreous humor 8 hrs. The results support the assertion of Loeb, "the activation of the ovule is accompanied by increased oxidations of which the cytoplasm is the seat."

L. W. RIGGS

Subepithelial and glycogen cells in embryo and recently hatched fish. FREDERICK W. ELLIS. *Science* 53, 418-20(1921).—E. reports a histologic study of the appearance of glycogen cells in *Perca flavescens* during the development of the embryo. These cells appear about the 6th day after the first division of the egg, and are shown by staining brown with dil. iodine soln. Blood cells appear a day or two later and in a few more days the liver is formed. The latter stains brick-red with iodine. The liver cells do not contain glycogen. As development proceeds the number of glycogen cells is gradually lessened by absorption, though their entire disappearance was not observed. Glycogen cells were found in most species of fish exand. but not in the recently hatched smelt or in *Fundulus*. It is suggested that if these cells can be isolated and cultivated in artificial media, they offer promising material for the exptl. study of the formation of glycogen.

L. W. RIGGS

## 12—FOODS

W. D. BIGELOW AND A. E. STEVENSON

Wilhelm Fleischmanns. GEORGE WIEGNER. *Landw. Vers. Sta.* 97, 261-92(1921).—An obituary. A list of his publications (190 in all) is included. F. M. SCHERTZ

Milk and meat in the food supply. *Public Health Reports by U. S. Public Health Service* 35, 994-8(1920); *Physiol. Abstracts* 5, 238.—The relative efficiency of the milch cow and the beef animal (in the production of milk and meat) in the conservation of proteins, fats, and carbohydrates, and in the gathering and preparation of mineral elements and vitamins is discussed. The estimates show that the milch cow is several times more efficient than the beef steer. A more abundant milk supply is desirable, even if this should reduce somewhat the production and consumption of meat. More of the grain crops than is the case at present should come directly into human consumption to augment the bread supply; and, of the grain given to cattle, more should be used for the production of milk and less for the production of meat. One qt. of milk is at least as great an asset in the family dietary as 1 lb. of meat.

E. H.

Hydrocyanic acid as a disinfectant of flours. MARCHADIER, GOUJON AND DE LAROCHE. *Mans. J. pharm. chim.* [7] 23, 417-20(1921).—The use of HCN for the

disinfection of wheat and other flours, as proposed by the Germans, should be prohibited until further exptl. work shall assure its safety.

F. F. HEYROTH

**The calcium content of egg-white.** HANS KREIS and JOSEF STUDINGER. Basel. *Schweiz. Apoth. Ztg.* 59, 193-6(1921).—A method used for the detection of eggs preserved in lime water has been the detn. of Ca in the egg-white ash. Ivan Röszenyi, *Chemiker Ztg.* 1904, 620. Polack and Weber (*Poggendorff's Ann.* 1849, 76) found the ash of a number of eggs in 3 detns. 0.59, 0.65, 0.73%, containing 1.74, 2.04, 2.79% CaO. A. Rakuskin found 0.41-0.60% ash, containing 2.0-2.5% CaO in 4 cases. K. and S. found 0.75, 0.77, 0.78% ash, with 2.64, 0.59, 0.96% CaO. In other tests eggs from 2 sources had (a) 0.75, 0.75% ash, and 2.37, 3.52% CaO, (b) 0.79, 0.80% ash, with 4.25, 3.87% CaO in the ash. Two fresh eggs from Croatia had 0.75, 0.76% ash, with 1.01, 1.06% CaO in the ash. The CaO content of the ash of eggs from the same hen yard is variable. Röszenyi's statement that the amt. of CaO in the ash of eggs kept 24 hrs. in lime water increased to 1.83-2.03% is valueless, as these amts. are found in some untreated eggs. His statement that the ash content of eggs dropped 2% after 35 months in lime water, while the per cent of CaO in the ash rose to 12.2-15.2%, is explained by his admission that the yolk membrane broke, allowing the yolk with a much greater Ca content (11.54-12.32% CaO in the ash) to mix with the albumin. Eggs kept in lime water showed after 19 days 0.8% ash, 1.18% CaO; after 23 days, 0.78% ash, 0.9% CaO; 38 days, 0.77% ash, 0.95% CaO; 7 months, 0.73% ash, 1.12% CaO. In another test the fresh eggs had 0.75% ash, 2.64% CaO; after 1 month, 0.8%, 2.04%; 3 months, 0.76%, 1.44%; 5 months, 0.78%, 1.43%; 6 months, 0.73%, 1.12%, resp. Eggs from Croatia kept 2 months in lime water had 0.91%, 12.0% (yolk mixed with albumin); 0.75%, 1.35%, 0.68%, 2.04%; 0.69%, 0.71% ash and CaO in ash, resp. Lime water eggs from Denmark of unknown age had 0.64%, 4.85% (yolk broken); 0.6%, 1.88%; 0.74%, 1.72; 0.66%, 1.79%. The CaO content of the albumin of fresh eggs varies from 0.59% to 4.25% of the ash. After they were kept months in Ca(OH)<sub>2</sub> no Ca was absorbed and the wt. remained the same. The detn. of Ca in the ash of the albumin gives no indication of the preservation of eggs in Ca(OH)<sub>2</sub>. The yolk membrane is quickly weakened in eggs so kept. The sp. gr. of eggs kept in the air gradually decreases, but remains unaltered in eggs kept in solns.

F. F. HEYROTH

**Note on the impurities of cacao.** E. WILCZEK. Lausanne. *Schweiz. Apoth. Ztg.* 59, 120-6(1921).—Under normal conditions, the impurities found in cacao shipments may afford valuable indications as to the source of the samples, and of their value. As a result of a study of the products discarded in the sorting of cacaos from different sources, W. gives a list of 44 impurities in Cameroun cacaos and of 19 in American cacaos. These are divided into those likely to be present in any sample, regardless of its source, and into those which are characteristic of the source. Of the latter, *Elaeis guineensis*, *Cocos nucifera*, *Amomum melaguella* and *grandiflorum*, *Cola vera* and *acuminata*, *Arachis hypogaea*, *Voandzeia subterranea*, *Physostigma cylindrosperma*, *Pentaclethra macrophylla*, *Monodora myristica* and *angolensis*, *Xylopia* spec. and *Carapa procera* are characteristic of samples from Cameroun; *Cocos* spec., *Batris* spec., *Astrocaryum* spec., *Maximiliana* spec., *Euterpe oleracea*, *Phylephas macrocarpa*, *Bertholletia excelsa*, *Dipterix odorata*, *Vitellaria mammosa*, *Mammea americana*, and *Cupoussou* (*Cupuassu*) are characteristic of those from tropical America. Factories dealing with cacao products should send the impurities discarded in sorting to competent botanists in order that these data may be extended.

F. F. HEYROTH

**A forage plant from the Solanaceae family.** B. H. HUNNICUTT. *J. Heredity* 10, 185-7(1919); *Physiol. Abstracts* 5, 256.—The Brazilian plant, *Solanum bullatum* is described. Chem. analyses are given. The plant contains an unusually high protein content.

E. H.

The chemical composition and the fodder value of a number of leaves and tender

shoots at different stages in their growing period. O. ENGELS. *Landw. Vers. Sta.* 97, 293-355(1921).—European alder, hazel nut, oak, beech, locust-tree, basswood, horse-chestnut, poplar, willow, birch ash and maple with others were used in the expts. The materials were found to possess considerable food value. The water content in early spring was about 70% while in the middle of October it averaged 50%. The protein content was highest in early spring and gradually decreased in autumn. The N-free extractive gradually increased from spring to autumn. The tannic acid content varied in the leaves and twigs but in all there was an increase as autumn approached. The digestibility of the proteins was highest in the material collected in the spring. The best material for feeding purposes can be collected from May to the end of July. Fodder value of the leafy twigs compares very favorably with meadow hay. The leaves are collected by being stripped off and the stems can be cut with a knife or scissors. Drying is important and a drying app. is recommended. The green color and aromatic smell must not be lost in drying. For the best results the ground materials mixed with molasses or feed cake is recommended and is suitable for all kinds of animals.

F. M. SCHERTZ

The digestibility of straw after treatment with soda. W. GODDEN. *J. Agr. Sci.* 10, 437-56(1920).—A method was studied in the laboratory for increasing the digestibility of straw and then applied under practical farm conditions. The method was devised for small-scale operations and differs in this respect from the German factory method (cf. *J. Min. Agr.* 26,15(1919)). The chopped straw is soaked over night in a 1.5% soln. of NaOH, then well drained and transferred to a steamer consisting of a vertical iron boiler, with loose cover and fitted with a steam pipe delivering steam near the base. The whole mass is raised to boiling and the steaming continued for an hour. The straw is then removed, thoroughly drained, allowed to cool and fed in this condition. Digestibility trials were made with 2 sheep, oat straw treated as above being used, and in addition alkali-free steamed straw, obtained by washing the treated straw. The former is termed "crude concentrate," the latter, "washed concentrate." From the av. compn. of the straw products it appears that the soda treatment causes a loss of crude protein, ether extract, and nitrogen-free extractives, and an increase in crude fiber. The total loss of dry matter in the prepn. of the "crude concentrate" was 20%; and 33.5% in the "washed concentrate." The protein content was so small that its digestibility was not measurable. The periods of feeding were each of 14 days' duration, at intervals of one week and arranged as follows: (I) untreated straw and casein; (II) crude concentrate and linseed cake; (III) untreated straw and linseed cake; (IV) washed concentrate and linseed cake. Results obtained show no appreciable differences of digestibility between the "crude concentrate" and the "washed concentrate," but do show a substantial improvement on the original straw, the digestibility of the organic matter being increased one-half, this increase being noted in both the nitrogen-free extractives and the crude fiber. By Kellner's method G. arrives at the following as the starch equivalents of 100 lbs. dry matter:

	Maintenance.	Production.
	Lb.	Lb.
Untreated straw	48.1	20.6
Crude concentrate	71.7	36.9
Washed concentrate	73.9	35.1

In other words the dry matter of the treated straw has roughly 1.5 times the value of the original dry matter, while for production purpose its value is nearly doubled. From the figures reported it is evident that the gain of nutritive efficiency is sufficient to compensate for the loss of dry matter. Further improvements in the process of treatment are being made but much further investigation of the possibilities of the

soda treatment are needed before a final opinion can be expressed as to its merits for farm practice.

R. B. DEEMER

**Digestibility of peat moss after treatment with acid.** W. GODDEN. *J. Agr. Sci.* 10, 457-9(1920).—In connection with the expts. reported previously (cf. preceding abstract) the digestibility of a proprietary product suggested as a feeding-stuff, made by subjecting finely shredded peat moss to the action of HCl gas and expelling the latter from the product was detd. by feeding a daily ration of the following ingredients: 284 g. linseed cake, 284 g. treated peat moss, 227.2 g. oat straw, 15 g. salt. By comparison with results obtained in the other expts. it was found that the digestibility of the peat moss is extremely low even as compared with untreated straw.

R. B. DEEMER

Studies on the treatment and disposal of industrial wastes. IV. Purification of creamery wastes (PHELPS, HOMMON) 14. Composition and properties of oat grain and straw (BERRY) 11D. A property of cider and the detection of its addition to wine (BALAYOINE) 16. Tartaric acid from tamarinds (SUBBOROUGH, VRIDHACHALAM) 10.

**Jahresbericht über die Fortschritte in der Untersuchung der Nahrungs- und Genussmittel.** 28th Jahrgang 1918. Edited by Heinrich Beckurts and F. Dietze. Göttingen: Verlag von Vandenhoeck und Ruprecht. M 18. For review see *Z. öffentl. Chem.* 27, 34(1921).

### 13—GENERAL INDUSTRIAL CHEMISTRY AND CHEMICAL ENGINEERING

HARLAN S. MINER

**Chemistry in warfare.** L. ROSENTHALER. Bern. *Schweiz. Apoth. Zig.* 59, 105-10 (1921).—A general discussion.

F. F. HEYROTH

**Armour Institute of Technology and its work.** ANON. *Elec. Rev.* 78, 859, 871(1921); 1 illus.—Historical, outline of courses, etc.

C. G. F.

**Our inventory.** W. S. LANDIS. *Trans. Am. Electrochem. Soc.* 39, preprint(1921); *Chem. Met. Eng.* 24, 813-6(1921).—Presidential address.

C. G. F.

**The Bern agreement and extension of the protective period.** B. ALEXANDER-KATZ. *Z. angew. Chem.* 34, Aufsatzteil, 65-66(1921).—Arguments against a decision that certain protected rights with reference to samples to be used for expts. (Gebrauchsmuster) expired in 1919, having run for the max. period—6 yrs.—provided by law, the claim being made that the Bern agreement automatically extended such proprietary rights, the use of which had been interrupted by the war.

W. C. EBAUGH

**Women in lead works.** ANON. *Electrician* 86, 642(1921).—British government regulations are defined.

C. G. F.

**The rate of drying of solid materials.** W. K. LEWIS. *J. Ind. Eng. Chem.* 13, 427-32 (1921).—A discussion of the fundamental factors affecting the drying rate—temp., humidity, and velocity of air, heat, "equilibrium moisture" (=moisture held when material is in equilibrium with air used in drying). In drying solids diffusion of moisture outward occurs as the surface film evaps., and the equil. point is approached rapidly at first, then more slowly. The skin effect is also considered. Consult the original for formulas and curves.

JEROME ALEXANDER

**The theory of atmospheric evaporation.** With special reference to compartment dryers. W. H. CARRIER. *J. Ing. Eng. Chem.* 13, 432-8(1921).—Air passing over a moist surface tends to drop to wet bulb temp. toward which its vapor pressure and "dew point" tend to rise. The material remains at the wet bulb temp. if evaps. freely,



but practically the rate of evapn. is limited by diffusion of moisture to the outer surface. The capacity of air for producing evapn. depends on its wet bulb depression. For formulas, drying chart and curves, see original.

JEROME ALEXANDER

**The compartment dryer.** W. H. CARRIER AND A. E. STACHY, JR. *J. Ind. Eng. Chem.* 13, 438-47(1921).—A discussion of air drying or conditioning, describing the advantages and limitations of compartment dryers. Among those considered are: direct radiation kiln, kiln with internal condenser coils, Wenborne-Karpen kiln, Hunter dry kiln, Cutler lumber kiln, Tiemann's dry kiln, dryer with floor diffusers, Gruff dryer, lattice floor and ceiling kiln, "perforated side walls" dryer, Gordon dryer, disk wheel cross circulation type, Carrier ejector dryer, and dehumidifiers.

J. A.

**The spray process of drying.** R. S. FLEMING. *J. Ind. Eng. Chem.* 13, 447-9(1921).—A description of the Merrell-Soule process for drying milk, etc.

JEROME ALEXANDER

**The immediate needs of chemistry in America.** WM. J. HALE. *J. Ind. Eng. Chem.* 13, 460-5(1921).—In brief they are: (1) plant efficiency, (2) scientific control of processes and output, (3) able chemists and engineers, (4) close collaboration of university and industrial researchers on industrial problems.

JEROME ALEXANDER

**Our anomalous Patent Office.** K. P. McELROY. *J. Ind. Eng. Chem.* 13, 469-70(1921).—The Patent Office is really a court, and should be so treated, rather than as an executive department bureau.

JEROME ALEXANDER

**Social industrial relations.** H. W. JORDAN. *J. Ind. Eng. Chem.* 13, 473-4(1921).—A plea that, although industry must pay in order to live, the social factors must be considered lest the industrial river dry up at its source.

JEROME ALEXANDER

**Problems of chemical engineering.** A. R. WARNES. *Chem. Trade J.* 68, 237-8, 273-5, 307-8(1921).—*Electrolytic corrosion* of Fe and steel in contact with soil or vegetation may be due to biological conditions. Certain bacteria produce  $H_2SO_4$ , decaying vegetable matter yields humic acid, soils contain other org. acids and root hairs excrete acid substances, all of which cause slow corrosion. Steel structures should be protected by a film which must possess flexibility, long life and insulating properties. In the *manuf. of foodstuffs* where bacterial action must be avoided, Al is recommended, joints being welded. Al is unattacked by most org. acids, its salts are colorless and non-poisonous and the metal is non-porous. The material of construction acting as a catalyst often affects the yield or quality of the product. *Surface combustion* is an important chem. engineering tool allowing great temp. range, high temp. ( $1450^\circ$ ), heat to be concd. at one point, and use of any combustible gas. The *use of wood* in chem. engineering is discussed; sp. gr., tensile strength and breaking wt. of various kinds of wood are given and danger from shrinkage, warping and attacks of fungi are mentioned. Cypress and redwood satisfactorily resist up to 5% HCl. Wood should not be used in contact with caustic alkalis. Hot water under pressure for heating purposes offers easy control and uniform temp. Geology bears on chem. engineering in the choice of a *plant site*. Thick strata of soft clay or gravel is to be avoided. In selecting *equipment*, the chem. engineer must always consider maintenance, various types of plant available and plant of proper capacity. Maintenance costs may be due to excessive friction, corrosion or stress. Operating one crushing roll 1% faster than the other reduces wear. Ball mills for *grinding iron borings* are better than edge runners. *Chem. corrosion* is due to wrong materials of construction, porous castings, faulty design or excessive stress. The bearing on factory costing of faulty plant, incorrect type of plant and plant of too large capacity is discussed.

C. C. HERRIAGE

**The lubrication of machinery.** ED. LIÉVÉNIÉ. *Age de fer* 36, 705-7(1920).—Notes on the general mechanism of lubrication and more particularly on graphite lubrication.

A. P.-C.

Metal substitution in chemical operations (MÄKELT) 9. The separation of miscible liquids by distillation (DUFREN) 2.

Annuario per le industrie chimiche e farmaceutiche. Anno II (1919). Rome: Tipografia Operaia Romana cooperativa. For review see *Oesterr. Chem. Ztg.* 24, 53(1921).

Bericht über Tätigkeit des Materialprüfungsamtes zu Berlin-Dahlem im Betriebsjahr 1920 (Apr. 1919–Mar. 1920). Berlin: Jul. Springer. For review see *Z. öffentl. Chem.* 27, 106(1921).

BUGGE, G.: Chemie und Technik. Leipzig: Verlag von Philipp Reclam Jr. M 4.50, bound M. 6. For review see *Z. angew. Chem.* 34, Aufsatzteil 39(1921).

DENSEN, EMIL: Norsk Industrie- og Næringshandbok. Vol. 4. Bergverk, Kraftanlæg og Elektricitetsverk, kemisk og elektrokemisk Industri. Kristiania: A.-S. Oekonomisk Literatur. 162 pp. 10 kr. For review see *Gummi-Ztg.* 35, 837(1921).

Substitutes from the Plant Kingdom. Edited by I. Diels. Stuttgart: E. Schweizerbart. 418 pp. For review see *Expt. Sta. Record* 43, 204.

Catalytic reactions; cracking hydrocarbons; hydrogen. CHEMICAL FUEL CO. OF AMERICA. Brit. 160,466, March 3, 1921. Processes in which C compounds, such as CO or hydrocarbons of high b. p. are in contact with a catalyst on which C ordinarily tends to deposit, are conducted in such a manner that the catalyst during the process is subjected to high-tension elec. spark discharges; by such treatment the deposition of C is obviated, and the catalyst is maintained in an effective condition. A suitable app. is given.

Insulating materials. F. J. HARDEN. Brit. 159,956, Dec. 4, 1919. An acid-proof insulating material which can be rolled or molded is made by mixing asphaltum, coal-tar pitch, S, paraffin wax, Fe or other silicate, finely divided C, and an inert body such as pumice.

## 14—WATER, SEWAGE AND SANITATION

EDWARD BARTOW

Experiences with iron in the public water supply at Shelby, Ohio. PHILIP BURGESS. *J. Am. Water Works Assoc.* 8, 193–200(1921).—See *C. A.* 15, 134. D. K. F.

Features of additional water works for St. Louis, Mo. E. E. WALL. *Munic. County Eng.* 60, 200–3(1921).—It is proposed to take a new supply from the Missouri River, 9 mi. above St. Charles, at first 60 mil. gal. per 24 hrs., later 120 million gal., which with the Chain of Rocks plant will serve 1,500,000 people. Engineering details are covered for intake, pumping station and purification. Sedimentation during 16 hrs. is proposed following 1 hour mixing with lime. Rapid filters are proposed. L. P.

Water supply surveys. H. B. HOMMON. Report to the Division of Sanitation and Inspection for the Med. and Surgical History of the World War. *Military Surgeon* 48, 550–60(1921).—A report form is given, followed by a summary report of the water supply survey of the 10th Training Area. G. C. BAKER

Posting and reporting water supplies. EMERY J. THERIAULT. Report to the Division of Sanitation and Inspection for the Med. and Surgical History of the World War. *Military Surgeon* 48, 534–9(1921).—The manner in which the information collected by the Water Supply Service was made available for the use of medical officers and brought to the attention of the enlisted men under their charge, and the measures used for putting into effect the recommendations for the improvement of the water supplies in training or rest areas are described. G. C. BAKER

**Maintaining the quality of the water of small water supply installations.** JACK J. HINMAN, JR. *Bull. Iowa State Institutions* 23, 24-30(1921).—This is a general discussion, dealing largely with the water of the supply before it reaches the pumps and is passed into the distribution system. From that point contamination is not of a serious character. Frequently bacteria may multiply in a pure well water as a result of unopposed life conditions, but this is of little significance. Occasionally dirty or poorly protected reservoirs are responsible for pollution, but the remedies are readily apparent.

G. C. BAKER

**Water supply for railroad transport service.** C. T. MALE. Report to the Division of Sanitation and Inspection for the Med. and Surgical History of the World War. *Military Surgeon* 48, 540-3(1921).—After a study of train schedules and a sanitary survey of the water supplies certain stations were selected as water stops. Facilities were developed to permit a train load of troops to fill their canteens with approved water in 10-15 min. Standard signs were posted on such water supplies, which were supervised by the Water Service.

G. C. BAKER

**Factors governing the selection and protection of sources of water supply.** J. K. HOSKINS. *U. S. Public Health Repts. Supplement No. 39*, 20 pp.(1921).—The factors that must be considered are the nature and extent of the use of the contemplated supply, the sources available, the quantity of water available, the quality of available supplies, the possibilities of pollution of the supply, the natural safeguards that may be employed for protecting the supply and the cost of installation and operation of the system. A bibliography classified under the above heads is given.

G. C. BAKER

**Ocher streams of the valleys of the Don and Loxley.** J. HAWORTH and J. EVANS. *J. Soc. Chem. Ind.* 40, 91-2T(1921).—The streams are fed largely by drainage from coal mines. The waters issuing from the mines contain  $\text{FeSO}_4$  and  $\text{Fe}_2(\text{SO}_4)_3$  and free  $\text{H}_2\text{SO}_4$ , primary oxidation products of pyrites. In the streams further reactions take place with the deposition of  $\text{Fe}(\text{OH})_3$  and basic ferric sulfates. In some cases the banks consist of this ocher several in. in depth. The ocher deposits have their origin in several ways: (1) direct oxidation and the production of  $\text{Fe}(\text{OH})_3$ ; (2) alkaline surface waters joining the stream; (3) the action of Fe bacteria which grow profusely in such waters. The water becomes acid and the usual flora and fauna of streams are entirely absent. In the rivers under consideration a pure stream of water is within two miles rendered practically unsuitable for industrial use of any kind except by treatment which must consist of neutralizing the acid and then softening.

G. C. BAKER

**An investigation of the Elbe River water at Magdeburg and Hamburg.** OTTO WENDL. *Z. angew. Chem.* 34, Aufsatzteil, 105-9(1921).—This is the annual report (1920) of an investigation started in 1904 of the Elbe River water. Daily and weekly analyses of the Magdeburg and Hamburg water supplies were made. The yearly av. of the analyses is given. In the winter bad odors and tastes, high salt concn., etc., at times resulted, owing to low water and lack of oxidation under freezing conditions. Use was made of the investigation for the relocation of the water supply inlet for these cities. Comparisons are also made of the results obtained in other yrs.

M. E. FLENTJE

**A contribution to the analysis of water.** VI. L. W. WINKLER. *Z. angew. Chem.* 34, Aufsatzteil, 115-6(1921); cf. C. A. 15, 1050.—A simplification of the V. Wartha method for the detn. of the total hardness of water is given, with tests of its accuracy. In the procedure the boiling, cooling, and filtering of the sample are omitted, the soda reagent being added in the cold. The ppt. is allowed to settle for 6-24 hrs. and the supernatant liquid titrated. Comparison of samples varying from 1° to 50° (German degrees) hardness, treated by both the original and simplified methods, gave an av. error of 0.25% for the simplified method. The time of reaction to give the most accurate results was 6 hrs. for hard and medium hard waters, and 24 hrs. for soft waters. VII. *Ibid* 143.—The effect of varying amts. of soda reagent on the

detc. total hardness by the O. Wartha method is given. In general, for a 100 cc. sample of water, 25 cc. of soda reagent gave the most accurate results. For very hard waters, however, 50 cc. of the reagent is recommended. Methods are given for the prepn. of solns. for the detn. of the total and Ca hardness of natural waters, by the use of palmitic acid and almond oil, instead of glycerol and alc., leading to a saving in chemicals. Gravimetric methods are given for the detn. of Ca and Mg, including the use of several means to shorten the time required. These include the use of Cd foil to prevent bumping, and a mixt. of alc. and ether to hasten the drying of the  $MgNH_4PO_4$  and  $CaC_2O_4$  ppts.

M. E. FLENTJE

**The detection of phenols in water.** R. D. SCOTT. *J. Ind. Eng. Chem.* 13, 422(1921).—The detection of phenols in water may be effected by distg. with acid and testing the distillate with the Folin and Denis phenol reagent.

G. C. BAKER

**Chlorination of water supplies.** WALTER C. RUSSELL. Report to the Division of Sanitation and Inspection for the Med. and Surgical History of the World War. *Military Surgeon* 48, 544-9(1921).—Wallace and Tierman machines for feeding liquid  $Cl_2$  at central plants with proper control gave a treated water free from odors and tastes. Chlorinated lime was used for hand sterilization of water in Lyster bags and water carts and tanks, while Javelle water was used in a few central plants rather than in hand sterilization in Lyster bags and water carts. Tastes and odors were avoided by adjusting the dosage, dechlorination with  $Na_2S_2O_4$  or allowing the water to stand until most of the  $Cl_2$  had been used in the oxidation of the org. matter. In the central plants the control of the treatment was maintained by bacteriol. examn. and by the use of indicators such as starch iodide or *o*-tolidine, which were also employed with Lyster bags and water carts, and steri-labs and chloro pumps.

G. C. BAKER

**Improvements in the purification of boiler feed water.** B. PREU. Cannstatt. *Z. angew. Chem.* 33, Aufsatzteil, 61-3, 70-2(1920).—It is maintained that for a purification method to be effective it should (1) remove free  $CO_2$ , O and oil from the feed  $H_2O$ ; (2) soften the  $H_2O$  by decomn. of scale-producing compds.; (3) remove by filtration the insol. compds. formed in (2); (4) feed the purified  $H_2O$  to the boiler at as high a temp. as possible; and (5) be economical to operate. Dealing with the older methods of purification there is a discussion of the soda-lime, the Ba compd. and the permutite methods, their chem. reactions, and physical difficulties. These methods are discarded as ineffective, and the new "Neckar" app. built by Philipp Müller at Stuttgart is recommended. This method uses only  $Na_2CO_3$ , but by suitable construction the reaction products are continuously removed from the boiler as sediment before it has opportunity to form scale within. Elaborate description of the app. with diagram and full explanation of the chem. reactions involved with ordinary waters are given. The Müller process is professed to fulfill the 5 requisites mentioned and to render satisfactory purification in an economical manner.

C. C. DAVIS

**The purification of boiler feed water.** A. KOLB. *Z. angew. Chem.* 33, I, 194-5 (1920).—Criticism of an article by Preu (cf. preceding abstr.).

G. C. BAKER

**Purification of boiler feed water.** D. B. PREU. *Z. angew. Chem.* 34, Aufsatzteil, 67(1921).—A reply to Kolb (cf. preceding abstr.).—Interesting data are given as to fuel and water saving in connection with the Müller hot process of boiler water purification. By condensing the blown-off steam, this app. effects a saving of 90% of the heat, and 18% of the water in the blown off steam, and by returning the condensate to the boiler there is a great saving of soda ash.

M. E. FLENTJE

**Pollution of river water in the Pittsburgh district.** C. M. YOUNG. *J. Am. Water Works Assoc.* 8, 201-17(1921).—The pollution is due primarily to industrial and mine wastes, the mines being the principal contributors;  $H_2SO_4$  and metallic sulfates are the main impurities. A discussion as to the formation of these sulfate impurities is followed by a résumé of the character of the troubles produced. The water used for

steam production causes the most trouble, and should be carefully treated prior to use. Owing to the discharge of sewage into streams, treatment for municipal use is equally necessary. **D. K. FRENCH**

**Effective dilution as a pollution unit.** WM. FIRTH WELLS. *J. Am. Water Works Assoc.* 8, 233-8(1921).—The term "effective dilution" is introduced as a unit whereby improvement by treatment, storage or diln. can be stated, i. e., 90% purification or a 7.5 days storage interval would have the same effect as an "effective dilution" of ten times. The value and use of the term in the relations of the engineer to the lab. is explained. Examples of its use are given. **D. K. FRENCH**

**Filtration plant for Scarboro Township.** ANON. *Can. Eng.* 40, 495-8(1921).—The works serve a population of 5000 with 500,000 imp. gal. per 24 hrs. Coagulation with  $Al_2(SO_4)_3$  is followed by filtration and chlorination. **LANGDON PEARSE**

**The economy of feed water heating and purifying, in the water works pumping station.** M. F. STEIN. *Munic. County Eng.* 60, 205-8(1921).—A general discussion of heaters, open and closed, feed water purifiers, water softeners, both lime and soda ash and zeolite. **LANGDON PEARSE**

**Report of the sub-committee on sewage works operation and analytical methods.** C. B. HOOVER, T. CHALKLEY HATTON AND W. L. STEVENSON. *Am. J. Public Health* 11, 548-51(1921).—A report form is suggested for sewage works operation and analytical methods. **G. C. BAKER**

**Report of the committee on sewerage and sewage disposal.** KENNETH ALLEN, T. CHALKLEY HATTON, JOHN F. SKINNER AND C. B. HOOVER. *Am. J. Public Health* 11, 548(1921).—The work of the committee was divided between two sub-committees: one on rural sanitation and one on sewage works operation and analytical methods. **G. C. BAKER**

**Report on equipment and operation of Chicago municipal reduction plant.** I. S. OSBORN. Report to Sub-Committee, City Council. *Eng. Contr.* 55, 476-80(1921).—The working of the plant is discussed in thorough detail. Sixty lbs. of garbage per capita were handled in 1920, with a recovery of 40 lbs. of grease per ton. Tankage runs 18% of garbage weight. The sale of products has varied. A comparison with the Cleveland plant shows uneconomical operation in Chicago. The labor costs have risen from 0.25 men days per ton in 1915 to 0.60 in 1920. Unless these costs can be reduced, leasing to a private company is advised. Also in *Eng. News-Record* 86, 856(1921). **LANGDON PEARSE**

**Studies on the treatment and disposal of industrial wastes. IV. Purification of creamery wastes.** EARLE B. PHELPS AND HARRY B. HOMMON. *U. S. Public Health Bull.* No. 109, 87 pp.(1921).—The report includes a description of the testing station at Grove City, Pa., with operating results obtained; also analytical methods used and a description of the character of the wastes. The equipment consisted of a scum tank, a weir box, storage tanks, pumping machinery, two settling tanks, an Imhoff tank and a septic tank, and two sand filters. The plant discharged a well purified effluent. For the treatment of this type of waste the authors recommend a septic tank followed by sand filtration. The septic tank should have a detention period of 48 hrs. with an additional space of 30% for scum and sludge accumulations. It should have 2 compartments sepd. by a concrete wall with small holes mid depth, and the inlet should be  $\frac{1}{2}$  of the vol. of the entire tank. Both the inlet and the outlet should be properly baffled and the hopper bottoms should have a 60° slope. The discharge should be by a siphon, which should be so regulated that it will discharge only enough waste to cover the sand filters to a depth of  $\frac{1}{4}$  in. The filter sand should be of medium size and the underdrains should be carefully prepd. The sludge and scum should be buried in shallow trenches and covered with soil. Imhoff tanks have no particular advantages over septic tanks; wooden tanks, owing to leakage, should never be used. A history of the literature, analyses, and a bibliography are given. **G. C. BAKER**

**The role of acidity in the dehydration of sewage sludge.** J. A. WILSON AND H. M. HESIO. *J. Ind. Eng. Chem.* 13, 406-10(1921).—Change of acidity has a marked effect upon the speed of filtration of sewage sludge. A pH value of about 3 gave the most rapid filtration for Milwaukee sludge. Acidity is slowly absorbed by the sludge and has an effect upon the sp. gr. and the elec. charge of the colloidal matter. The diln. of the sludge is of prime importance. G. C. BAKER

**Privies and sewage disposal for farms.** WM. PAUL GERHARD. *Am. J. Public Health* 11, 564-7(1921).—This is a warning against pit privies and an argument for receptacle types of privies. The water-carriage sewage-disposal system is preferable but expensive; liquefying vault and chem. closet systems require careful attention, while septic and scum tanks are insufficient unless followed by further purification. Incinerators may be used in case of infectious diseases. The more complicated systems, as Imhoff tanks, contact filters, and trickling and contact filters are not adaptable for use on the farm. G. C. BAKER

**Effluents from small Imhoff tanks clog dosing devices.** C. P. RHYNUS. *Am. J. Public Health* 11, 569-70(1921).—Expts. indicate that an Imhoff tank should not be used in connection with a splash plate, nozzle or floating valve unless daily supervised. If dosing devices must be used, a septic or biolitic tank with a self-cleaning screen at the effluent end would be more satisfactory for small plants. G. C. BAKER

**Report of the sub-committee on rural sanitation.** JOHN F. SKINNER, HENRY N. OGDEN AND JOHN C. DIGGS. *Am. J. Public Health* 11, 551-64(1921).—There are given a statement of principles to be observed, type plans with diagrams for plants of various capacities and recommendations for the aid of rural dwellers and public health officers. A brief bibliography of the literature on sewerage and sewage treatment for rural districts is appended. G. C. BAKER

## 15—SOILS, FERTILIZERS AND AGRICULTURAL POISONS

J. J. SKINNER AND ALBERT R. MERZ

**Report on Soils.** C. B. LIPMAN. *J. Assoc. Official Agr. Chemists* 4, 388-9(1921).—A report of the detn. of P in Davis and Oakley soils by the  $Mg(NO_3)_2$  method and the  $Na_2O$  method. Both methods are to be studied further. F. M. SCHERTZ

**Science and the reclamation of moorlands.** BR. TACKE. *Z. angew. Chem.* 33, Aufsatzteil, 293-5(1920).—An address of a general nature. J. DAVIDSON

**Studies of a Scottish drift soil.** W. G. OGG AND J. HENDRICK. *J. Agr. Sci.* 10, 333-57(1920).—The expts. of this study are divided into 2 parts. II. The absorptive power of the soil and of its mechanical fractions; the org. matter and its distribution in the fractions; absorptive power for  $NH_3$  of the soil and its fractions; and distribution of the absorptive power among the fractions, are the phenomena studied. A glacial drift soil which has not undergone very profound weathering and is free from  $CaCO_3$  gave the following absorption of  $(NH_4)_2SO_4$  per 10 g. soil: fine gravel, 0.001 g. N; coarse sand, 0.001 g. N; fine sand, 0.003 g. N; silt, 0.010 g. N; fine silt, 0.015 g. N; clay, 0.017 g. N, and original soil, 0.006 g. N. "It seems probable, from the results obtained that the absorptive power is not detd. by surface alone, and that the chem. compn. of the fractions has an influence on the absorptive power." It is suggested that by dividing the soil into fractions and comparing the absorptive powers of them surface differences may be largely eliminated, and it may be possible to study the influence of differences of chem. nature and geological origin on absorptive power of soils. III. Comparison of the absorptive power of crabstone soil and granite fractions, absorption after ignition, and retention of absorbed  $NH_3$  by unweathered material were studied. Absorption of  $(NH_4)_2SO_4$  per 10 g. of granite was as follows: fine gravel, none; coarse sand,

0.001 g. N; fine sand, 0.002 g. N; silt, 0.004 g. N; fine silt, 0.011 g. N; clay, 0.021 g. N. Comparison of these figures with those obtained upon the soil fractions brings out the similarity between the absorption of the two. The absorptive power of both soil and granite is very much reduced by ignition, the lowering being greater for the soil. "The absorbed  $\text{NH}_3$  is only gradually washed out by  $\text{H}_2\text{O}$  but the whole of it is not removed in this way, a point being reached when practically no more  $\text{NH}_3$  is removed. Absorption by powdered granite and probably also by the unweathered or little weathered materials in soils, seems to be largely an adsorption effect." R. B. DEEMER

**Acid soil studies. I. A study of the basic exchange between soil separates and salt solutions.** R. H. ROBINSON. *Soil Sci.* 11, 353-62(1921).—Soil separates of 4 acid Oregon soils were treated with 0.1 N solns. of KCl,  $\text{KNO}_3$ , NaCl,  $\text{K}(\text{C}_2\text{H}_3\text{O}_2)$  and  $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$ . By the Veitch and the Jones method the lime requirement of these soils varied from 1500 to 20,800 lbs. of  $\text{CaCO}_3$  per 2,000,000 lbs. of soil. Pot expts. and field tests have failed to show a beneficial effect of the application of lime to these soils on crop yield. The acidity of the different soil separates liberated by the action of a given salt soln. was approx. the same. The so-called acidity liberated by  $\text{KNO}_3$ , KCl and NaCl was due mainly to Al and Fe rendered sol. by basic exchange. The acidity produced by  $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$  and  $\text{K}(\text{C}_2\text{H}_3\text{O}_2)$  was due to AcOH liberated either by replacement of the H of the hydrogen silicates or by selective absorption of the basic element in the salt soln. The H-ion concn. of different separates of the soil was const. **II. Changes in calcium compounds added to acid soils.** R. H. ROBINSON AND D. E. BULLIS. *Ibid* 363-7.—In an effort to explain why some acid Oregon soils do not respond to lime treatment pure  $\text{CaCO}_3$  or CaO was added to 4 acid soils in pots and allowed to weather for 1 year. A crop of barley was also grown in the pots. At the end of one year samples were removed from the pots and the forms into which the Ca compds. had changed detd. The Ca retained was found combined chiefly with humus and easily decomposable silicates. Most of the Ca present in the acid soils that does not respond to lime treatment was found combined as difficultly decompd. silicate. The soils after exposure were alk. according to the Veitch method. W. J. ROBBINS

**The flocculation of soils.** N. M. COMBER. *J. Agr. Sci.* 10, 425-36(1920).—This is an attempt to correlate the flocculation of soil particles with the established facts of colloid chemistry. Account is taken of the 2 following important causes of complication bearing upon the action of electrolytes on the soil. First, "the soil particles are 'protected' by org. and inorg. colloids; second, the soil is a system of particles of all sizes." Hence a comparison of flocculation in the soil with coagulation in a simple suspensoid sol is impossible. Further light upon this subject was expected from a study of the effect of alkalinity on flocculation. Very minute details of the expts. on 8 soils are given. A lengthy discussion of the results and the following summary conclude the article: "'Silt' like most insol. substances, when suspended in  $\text{H}_2\text{O}$  is most easily flocculated by Ca salts when the suspension is neutral. The addition of alkali stabilizes the suspension and renders flocculation more difficult. Soil 'clay,' however, behaves in an opposite manner; it pptd. from alk. suspensions more readily than from neutral suspensions. In this behavior clay resembles silicic acid and some other members of the so-called 'emulsoid' colloids. It is suggested that the clay particles are protected by such colloids and thus behave as an 'emulsoid' and not as a 'suspensoid.' If this is true then the action of CaO, which being alkaline nevertheless flocculates clay, is seen to be in accordance with the facts of colloid chemistry. The view is advanced and some experimental support of it is described, that clay, as an 'emulsoid,' protects the larger particles which by themselves are 'suspensoid.' The soil aggregates are conceived as having large nuclei surrounded by particles which become smaller from the center of the aggregate outwards, the clay ultimately imposing its 'emulsoid' nature on the whole aggregate, and on the whole soil in normal cases. Fine silt soils

are not flocculated by  $\text{Ca}(\text{OH})_2$  on account of the inefficiency of the relatively small amt. of 'emulsoid' clay to protect the large 'suspensoid' surface exposed by the fine silt."

R. B. DEEMER

**Improvement of peaty soils. I. True peats.** E. J. RUSSELL. *J. Ministry of Agr.* 27, 1104-13(1920).—Three types of English peat soils are described. The methods of reclamation, improving and cropping for each type are fully discussed. J. DAVIDSON

**The improvement of peaty soils. II. The silty and sandy peats.** E. J. RUSSELL. *J. Ministry Agr.* 28, 32-5(1921).—The cultivated silty peats in Bodmin moor, Carnivall, are not acid, while the uncultivated are distinctly so. They differ only slightly in chem. characteristics. The sandy peats of St. Buryan's district, Carnivall, are very acid; they can be reclaimed by deep plowing, lime and phosphate. J. J. SKINNER

**Effect of partial sterilization of the soil with calcium sulfide.** G. TRUFFAUT AND N. BRZSSONOV. *Compt. rend.* 171, 268-71(1920).— $\text{CaS}$  and naphthalene or  $\text{CaS}$  and cymene were used as means of partial sterilization of the soil. Under conditions favorable to aeration this sterilizing mixt. caused a loss of N from the soil—probably owing to the formation of ammoniacal N. It also favored the development of anaerobic bacteria, as *Bacillus butyricus*, for instance. When this sterilizing mixt. was used under similar conditions in connection with growing plants (poppies) the loss of N from soil was very small. Taking in consideration the fact that the crop from the partially sterilized soil was 3 times as large as that from untreated soil, one must conclude that the sterilization resulted in an actual gain of N. The application of  $\text{CaS}$  under ordinary conditions at the rate of 150 kg. per hectare did not result in any loss of N from the soil notwithstanding the removal of N in increased yields.

J. DAVIDSON

**The effect of liming on the composition of drainage water of soils.** T. L. LYON. *J. Am. Soc. Agron.* 13, 125-30(1921).—Applications of  $\text{CaO}$  and  $\text{CaCO}_3$  usually increase nitrification and removal of N in drainage water. Gypsum appears to have a depressing effect on nitrification and nitrogen removal when applied in comparatively large quantities. The effect of liming on removal of S in drainage water is not clearly understood. Liming usually increases the removal of Ca in the drainage. K apparently is not greater in drainage from limed soils. P occurs only in very small quantities in drainage water.

F. M. SCHERTZ

**Liming in its relation to injurious inorganic compounds in the soil.** S. D. CONNER. *J. Am. Soc. Agron.* 13, 113-24(1921).—Lime may act on injurious inorg. compds. in the soil in 3 ways: it neutralizes soil acidity by decreasing the H-ion concn.; it ppts. most injurious sol. salts which are found in acid soils; and it, to a certain extent, acts in an antagonistic manner towards excessive sol. salts which may not be pptd. Al, Fe, Mn, B and Zn in sol. forms are harmful but they may be rendered less sol. and less injurious by lime. The presence of sol. Al salts accounts for much of the harmful acidity of acid soils. Al toxicity is in part due to the Al ion. Abundant phosphate when present in nutrient solns. prevents Al injury, by pptn. At  $p_H$  3.9 Al is more completely pptd. as a phosphate than it is at  $p_H$  6.0 as a hydroxide. Al is much more insol. as a silicate than it is at the same acidity as a hydroxide. In field plots, lime alone did not produce optimum crops on an acid black sand. Half a ton of acid phosphate or one ton of dicalcium silicate per acre produced good crops on limed land. On sandy and peaty acid soils low in active silica, liming should be supplemented by available phosphates to correct Al toxicity. More active forms of silicates somewhat aid in pptg. Al salts.

F. M. SCHERTZ

**Report on the lime absorption coefficient of soils.** W. H. MACINTYRE. *J. Assoc. Offic. Agr. Chem.* 4, 389-90(1921).—The Jones  $\text{Ca}(\text{OAc})_2$  method for detg. the lime absorption coeff. is as follows: Mix 5.6 g. of soil and 0.5 g. of  $\text{Ca}(\text{OAc})_2$  in a 3-in. mortar, add water to make a fairly stiff paste, pestle for 20 sec., add 30 cc. water and con-



tinue mixing for 30 secs., wash into a 200-cc. flask, keeping the bulk down to about 160 cc., let stand with occasional shaking for 15 min., make up to 200 cc., mix and filter through a dry filter. Discard the first 10-15 cc. which may be cloudy. Titrate 100 cc. of the clear filtrate, using phenolphthalein as an indicator with 0.1 N NaOH. Multiplying the reading by 2 gives the cc. of 0.1 N alkali required to neutralize the AcOH in 200 cc. of the soln. This figure times 1.8 times 1000 indicates the lbs. of CaO required per 2,000,000 lbs. of soil.

F. M. SCHERTZ

**Qualitative tests for sour soils.** N. M. COMBER. *J. Agr. Sci.* 10, 420-4 (1920).—In this test 2-3 g. of soil are placed in test tubes and 5 cc. of concd. alc. soln. of KCNS added. Soils having a lime requirement give a pink or red color within an hour. With soils having a requirement as low as 0.03% CaCO<sub>3</sub> the color is not pronounced at the end of an hour, but with an alc. soln. of the reagent the test becomes more delicate, and the reaction is apparent in 5 min. The alc. soln. is prepd. by dissolving 40 g. of KCNS in 1 l. of 95% EtOH. NH<sub>4</sub>CNS is much less sensitive, while an alc.-ether soln. is much more sensitive than the EtOH soln. of KCNS, and may be used for borderline cases. In using the alc. soln. the same amt. of soil and reagents are used as given above. Filtering is helpful if the pink color should be only faintly pink. The color deepens for about 48 hrs., though final equil. is probably only established after a much longer period.

R. B. DEEMER

**Sulfur for neutralizing alkali soil.** P. L. HIBBARD. *Soil Sci.* 11, 385-7 (1921).—Alkali soil to which 1% S was added was incubated several months. The alkali was neutralized by the oxidation of the S. The alkalinity of soils was detd. by titrating a H<sub>2</sub>O suspension and the theoretical amt. of S for neutralization added. In 10 days from 50 to 90% of the original alkalinity had been neutralized in all but 2. An alkali soil on which barley germinated poorly was treated with S. After 2 weeks the alkalinity disappeared and barley would germinate. Alkali soils may be made more fertile by neutralizing their alkalinity by the use of S.

W. J. ROBBINS

**Contributions to our knowledge of soil fertility. XVI.** R. GREIG-SMITH. *Proc. Linnean Soc. N. S. Wales* 43, 142-90 (1918); *Physiol. Abstracts* 5, 265; cf. C. A. 13, 154.—This work deals with the production of toxins by soil organisms. Using *B. prodigiosus* as a test organism, G. concluded that various soil organisms, including bacteria, molds, and amebae, do not, as is generally supposed, produce toxic substances. Various media were tested, and in no case could toxin production be demonstrated. Phenomena resembling those associated with toxins are to be ascribed to changes in the acid reaction of the medium (to which, it may be noted, *B. prodigiosus* is very sensitive). Two types of humic acid were detected in leaf mold. Heating the humus increased its sol. acid content.

E. H.

**Analyses of the soils of Cruz Alta and Monteros, Argentine Rep.** IVÁN R. FONTANA. *Informes dept. investigaciones ind. Univ. Tucumán* 6, 25-33 (1918); cf. C. A. 13, 51.—Physical and chem. analyses of 4 soils are given. The causes of citrus foot rot are discussed and the application of phosphates to the soil is recommended as a remedy.

L. E. GILSON

**Determination of the water-soluble and citrate-soluble phosphoric acid.** BERTIL EKHOLM. *Svensk Kem. Tid.* 32, 211-4; 33, 7-12 (1920-1).—A discussion of the differences in the analytical results of the detn. of the sol. P<sub>2</sub>O<sub>5</sub> by treatment with water or citrate due to small variations in the methods officially prescribed in various countries.

A. R. ROSE

**The effect of organic nitrogenous compounds on the nitrate-forming organism.** E. B. FRED AND AUDREY DAVENPORT. *Soil Sci.* 11, 389-407 (1921).—*Nitrobacter* grew on washed nitrite-agar and on slants of Nährstoff-Heyden agar with and without NO<sub>2</sub> present. From a microscopical examn. of liquid cultures in H<sub>2</sub>O, wine,

peptone-beef infusion, and Nährstoff-Heyden soln. it was found that the bacteria do not reproduce in such media. Nährstoff-Heyden soln. was non-toxic but beef infusion or peptone-beef infusion in the higher concns. was toxic. The harmful material is non-volatile and can be removed by extn. by ether or alc. *Nitrobacter* will live 2-6 weeks in 1% solns. of Nährstoff-Heyden, gelatin, peptone, casein, yeast water, and in milk or distd.  $H_2O$ . Gelatin, peptone, casein, skimmed milk, beef infusion and beef ext. did not decrease oxidation of  $NO_2$ ; asparagine,  $(NH_4)_2SO_4$  and urea retarded the oxidation; Nährstoff-Heyden increased it above water controls. Sealed agar slants of *Nitrobacter* were kept more than a year without serious injury to their power of oxidation.

W. J. ROBBINS

The nitrogen requirement of Switzerland and the technical ways of producing the lacking nitrogen fertilizers. O. NYDEGGER. *Schweiz. Chem.-Ztg.* 1921, 89-94, 101-4; cf. C. A. 15, 1183.—N. describes the processes used in the production of fixed N ( $CaCN_2$ ,  $NH_3$ , and  $HNO_3$ ). He estimates the amt. of energy per ton required to produce the respective N products and considers the materials used in their production, principally from the standpoint of availability. Owing to the fact that Switzerland is relatively poor in coal and rich in water power, he recommends the production of  $HNO_3$  by the elec. arc process as the best means of supplying the lacking N fertilizers of that country. He also recommends the use of the synthetic  $HNO_3$  produced this way in the production of superphosphates instead of the commonly used  $H_2SO_4$ . He further suggests the use of this synthetic product in the manuf. of urea nitrate and  $Ca(NO_3)_2$  from  $CaCN_2$  by a process devised by Schellenberg and himself. This urea nitrate can also be used in the production of superphosphates as the nitrate radical readily unites with the Ca of the rock phosphate.

J. DAVIDSON

A few facts regarding chemical fertilizers. P. WAGUET. *Rev. prod. chim.* 23, 401-4(1920); cf. C. A. 14, 2526.—The article is devoted principally to a discussion of radioactive fertilizers. The use of these fertilizers is becoming quite popular in France. They are sold on the market under 2 names, l'Excitator Agral and le Radioactif B.D. R. (Bunque du Radium). These com. products contain 0.026-0.036% U oxide and are applied at the rate of 40-50 kg. per hectare. Their application is more advantageous when done together with a complete fertilizer. Malpeaux and Lefort obtained beneficial results from the application of radioactive fertilizers to oats, sugar beets, potatoes and mangoes. Other scientists report similar results. The beneficial results obtained with these fertilizers are due to their (a) physical effects, which might express themselves, for instance, in changes of elec. cond., (b) to their chem. effects, the radial emanations acting as catalyzing agents, and (c) to their biological effect, which might result in stimulated cell division. These fertilizers act directly on the plant which is being cultivated and indirectly through their effect on the microflora of the soil.

J. DAVIDSON

The influence of fertilizers containing borax on the yield of potatoes and corn. Season 1920. A. W. BLAIR AND B. E. BROWN. *Soil Sci.* 11, 369-83(1921).—Borax in quantity of 1-400 lbs. per acre and mixed with a fertilizer contg. cottonseed meal, acid phosphate, and KCl was applied to corn and to potatoes in 3 sections. In section 1, the borax was drilled in the furrow 2 or 3 weeks before planting, in 2 drilled in the furrow at the time of planting and in 3 broadcast over the furrow at the time of planting. With potatoes in section 1, 50 lbs. of borax had little or no effect, 100 lbs. cut the yield  $\frac{1}{2}$  and 400 lbs. produced a failure; in section 2, 30 lbs. caused a drop in yield and 50 lbs. reduced it to  $\frac{1}{4}$ ; in section 3, the 50 lb. application decreased the yield slightly. With corn in section 1, depression of germination was noted with 20 lbs. per acre, and in sections 2 and 3 with as little as 5 and 10 lbs. On section 1 no depression of yield was found with 50 lbs. per acre but 100 lbs. produced a decided

decrease. On sections 2 and 3 with 50 lbs. the yield was reduced to  $\frac{1}{3}$ . That larger quantities are required to produce injury on section 1 is believed to be due to the diffusion of the borax in the soil and its absorption aided by the ppt. W. J. ROBBINS

**The determination of citrate-soluble phosphoric acid in superphosphates.** PAUL MÜLLER. *Chem.-Ztg.* 45, 178(1921).—It was found that the regrinding of the sample, the length of the time of digestion and the stoppering of the digestion flasks had no effect on the results of analysis. It was found, however, that the time of standing after the addition of the magnesia mixt. had a marked effect on the accuracy of the results. Shaking for  $\frac{1}{2}$  hour in a shaking app. had been recommended in place of long standing. This was found to be true in the case of Thomas meal. With superphosphates a night's standing after shaking gave invariably higher results. It is the presence of sol. salts in superphosphates that interferes with the pptn. of the  $MgNH_4PO_4$ .

J. DAVIDSON

**The reversion of superphosphate.** BERNHARD NEUMANN AND KURT KLEYEIN. *Z. angew. Chem.* 34, Aufsatzteil, 77-80, 84-6(1921).—It is a well known fact that superphosphate is being reverted under storage conditions. The principal cause of this reversion is the presence of  $Fe_2O_3$ ,  $Al_2O_3$ , and of kaolin in the original rock phosphate from which the superphosphate is made. The  $Fe_2O_3$  content is particularly responsible for the reversion. It was found by the authors that the presence of  $Fe_2O_3$  in the original rock phosphates up to 2% does not cause any considerable reversion of the superphosphate. The remedy suggested is to keep down the percentage of  $Fe_2O_3$  in the rock used in the manuf. of superphosphate by mixing rock rich in  $Fe_2O_3$  with rock of a very low  $Fe_2O_3$  content.

J. DAVIDSON

**The utilization for fertilizing purposes of the carbon dioxide driven off in the combustion of fuels.** FRIEDR. RIEDEL. *Chem.-Ztg.* 45, 157-8(1921).—R. has recommended in previous articles the utilization of  $CO_2$  obtained in the combustion of fuels for fertilizing purposes. He made his recommendations on the basis of expts. performed by himself and other investigators. In this article he takes issue with Claassen (*C. A.* 14, 3745) who has questioned the feasibility of this plan.

J. DAVIDSON

**Comparison of results obtained by the de Roode, official Lindo-Gladding and former official Lindo-Gladding methods for the determination of potash in mixed fertilizers.** E. R. TOBEY. *J. Assoc. Official Agr. Chemists* 4, 377-9(1921).—Mfrs. maintain that the official Lindo-Gladding method does not account for all of the water-sol. potash, the error being due largely to occlusion. A modification of the de Roode method gave results far from satisfactory. In general the results obtained by the official Lindo-Gladding method are lower than the corresponding results by the former official method.

F. M. SCHERTZ

**The determination of water-soluble arsenic oxide in calcium arsenate.** J. J. T. GRAHAM. *J. Assoc. Official Agr. Chem.* 4, 406-8(1921).—The official method for detg. water-sol. arsenic in lead arsenate was found applicable for the same detn. in Ca arsenate.

F. M. SCHERTZ

**Report on insecticides and fungicides.** O. B. WINTER. *J. Assoc. Official Agr. Chem.* 4, 395-403(1921); cf. *C. A.* 15, 1371.—The report includes the detn. of Pb, Zn, and Cu in mixts. which may contain As, Sb, Pb, Cu, Zn, Ca, and Mg; the removal of London purple before detn. of total As; and comparisons of the official iodine, the Gyory bromate and Jamieson iodate methods for the detn. of As.

F. M. SCHERTZ

**Relative adhesiveness of the copper fungicides.** O. BUTLER AND T. O. SMITH. *Phytopathology* 9, 431-43(1919); *Physiol. Abstracts* 5, 267.—A paper of practical interest, giving the relative adhesiveness of Burgundy and Bordeaux mixts. of various compns., and with the addition of various extra ingredients, such as gelatin,  $FeSO_4$ , Na arsenite, etc.

E. H.

The solubility of calcium and magnesium arsenates in carbon dioxide and its relation to foliage injury. A. J. PATTEN. *J. Assoc. Official Agr. Chem.* 4, 404-6(1921); cf. *C. A.* 14, 446.—It is questioned whether Ca or Mg arsenate can be used under any circumstances on tender foliage and it further is not known if its soly. in  $\text{CO}_2$  can be used as a measure of safety.

F. M. SCHERTZ

A chlorosis of conifers corrected by spraying with ferrous sulfate. C. F. KORSTIAN, C. HARTLEY AND G. G. HOLM. Bureau of Plant Ind. *J. Agr. Research* 21, 153-71 (1921).—Chlorosis in western yellow pine and Douglas fir at an Idaho nursery and in jack pine and western yellow pine at a Nebraska nursery was corrected or improved by spraying at 10-day intervals using a 1% soln. of  $\text{FeSO}_4$  in amts. sufficient thoroughly to wet the tops. A 2% soln. ultimately caused chem. injury to the plants. No definite correlation has been found between chlorosis and the amt. of Ca or of carbonate in the soils, although the 3 soils on which the conifers have been found decidedly chlorotic all contained considerable amts. of carbonate, nor has the importance of excessive soil moisture as a cause of chlorosis been detd.

F. C. COOK

Composition and properties of oat grain and straw (BERRY) 11D. Comparison of *Azotobacter* with yeasts (MULVANIA) 11C. Composition of linseed (FAGAN) 11D. Analysis of leucites and leucitic minerals (TOMMASI) 7. The effect of finely divided materials on the freezing points of water, benzene and nitrobenzene (PARKER) 2.

Insecticides, etc. SOC. ANON. DE PRODUITS CHIMIQUES ÉTABLISSEMENTS MALÉTRA. Brit. 160,165, March 14, 1921. Insecticides, fungicides, and disinfectants are prepd. by boiling a mixt. of  $\text{CaO}$ , S, and  $\text{H}_2\text{O}$  in an open vessel or an autoclave until an orange or brown color is obtained. The resulting paste may be run directly into packages in which it sets on cooling, or may be cast into a slab. The proportions of the ingredients used and the method of manuf. may be such that the product contains only S compds. of Ca, or that free  $\text{CaO}$ , or free S, or both may be present in addition. The  $\text{CaO}$  may be added in the form of milk of lime. The solid product is dissolved in hot  $\text{H}_2\text{O}$  for use or, in place of a solid product, a concd. soln. may be prepd. directly.

Vermin-destroying compositions, etc. A. E. HAWKER. Brit. 160,511, Dec. 15, 1919. A prepn. for the destruction of insects and vermin on plants or animals and for destroying soil pests and fungoid growths consists of an oil distd. from hard wood in combination with soap or otherwise emulsified. The wood oil is obtained by redistn. of the tarry layer that seps. from the pyroligneous acid in the temp.-controlled distn. of hard woods. The fraction collected until the sp. gr. of the distillate reaches approx. 0.98 is preferably employed. A prepn. containing 12 parts of wood oil and 88 parts of soap may be put up in the form of tablets, or dried and powdered with or without the addition of lime, gypsum, kieselguhr, chalk, fuller's earth, borax, or other absorbent, or may be formed into a soln. with  $\text{H}_2\text{O}$  to which glycerol, gum arabic, or alc. or other solvent may be added.

Sheep and cattle dips and washes. I. McDougall and F. Howles. Brit. 160,597, Jan. 7, 1920. Na arsenite is concd. by evapn. after mixt. with a colloid. By this means the material remains fluid even when concd. to contain 50% and upwards of the oxide. Thus 80 parts by wt. of  $\text{As}_2\text{O}_3$  are mixed with 22 1/4 parts by wt. of  $\text{NaOH}$ , and addition is made of a colloid such as hydrolyzed starch, hydrolyzed glue, casein, or soap made from liquid resin. The mixt. is concd. by evapn., but remains fluid and can be dild. by the mere addition of  $\text{H}_2\text{O}$ . Where the % of  $\text{As}_2\text{O}_3$  in the dip or wash is less than about 50, sodium arsenite of the requisite concn. may be produced directly from  $\text{As}_2\text{O}_3$  and  $\text{NaOH}$ , and the colloid added to prevent subsequent sepn., there being thus no necessity for evapn. Cf. *C. A.* 15, 1961.

## 16—THE FERMENTATION INDUSTRIES

H. S. PAINE

Analysis of a wine of the palm-tree or "laghmi" of South Tunis. A. MARCAILLHOU, D'AYMERIC. Gabes (Tunis). *J. pharm. chim.* 23, 272-3(1921).—For more than a month, 7-8 l. per day of sap, "laghmi," may be obtained from the palms of the oases. It is a very fermentable, opalescent liquid, with the odor of sweet wine, sp. gr. 1.0295. It has  $H_2O$ , 82%;  $EtOH$ , after 8 days, 4.5%; total acid as  $H_2SO_4$ , 0.7%; volatile acid, 0.22%; glycerol, 2%; reducing sugars, 0.2%; gums, 3%; mineral substances, 7%. The ext. left on drying at  $100^\circ$  (10.5%) is partly sol. in  $EtOH$ ; the insol. part is composed of gums and sweet substances. The gums are sol. in boiling  $H_2O$  and reprecipitated by  $EtOH$ , and give a characteristic reaction with ferric salts. The ash (0.2%) contains K, Na, Ca, Cl, and traces of phosphates, Fe, and Mn. F. F. HEYROTH

A property of cider and the detection of its addition to wine. PIERRE BALAVOINE. Geneva. *Schweiz. Apoth. Ztg.* 59, 197-201, 212-15(1921).—In detns. of the alkalinity of the ash of wines the solns. must be kept on the water-bath until all  $CO_2$  has escaped before titrating with 0.1 N  $H_2SO_4$ . The German commission for official wine statistics gave the total and the water-sol. ash alkalinities of wines from 1908 to 1912 so that B. was able to calc. the alkalinity of the water-insol. portion of the ash. Of 1800 5-year red and white wines of variable compn., only 120 had an alkalinity of the sol. portion slightly greater than that of the insol. portion; all others conformed to the rule previously announced (*C.A.* 14, 2048). Many of the exceptions were wines abnormally low in  $EtOH$ . The alkalinity detns. were made by the commission with 0.4 N  $HCl$ , after boiling. A number of results are also tabulated for ciders examd. by the commission, showing that in ciders the ratio of sol. alkalinity to insol. alkalinity is usually greater than 5. In foreign wines the ratio is always less than 1, and often less than 0.5; for white Geneva wines it is 0.5-1 (except in 5 wines out of 49). In red Geneva wines it is 1-2, with 4 exceptions (13 detns.). These recent results lessen the possibility of detecting the blending of cider, although these exceptional wines are rare. They have a characteristic taste, and probably are due to the peculiar long fermentation with the stems employed in Geneva; they have their acids satd. by the dissolved alkalies, leaving only a slight excess for the alkaline earths, and resemble "piquettes," wines of second fermentation. Alkalinity ratios calcd. for "piquettes" from the detns. of Fresenius-Grünhut (*Annal. Chem.* 1899, 429) were as high as 3. The large proportion of alkaline carbonates in the ash of ciders is maintained even after blending with wines. Much  $K_2SO_4$  diminishes the sol. alkalinity, since less of the K in them is combined with the tartaric acid, and, as the insol. alkalinity is only slightly altered, there is a notable diminution in the critical ratio. The addition of  $H_2SO_4$  or of too great an amt. of  $SO_2$  may reduce the sol. alkalinity to zero. The high sol. alkalinity of some wines may be due to a large proportion of  $KHC_4H_4O_6$ . The detn. of the alkalinity of the ash of the alc. filtrate of wines evapd. to dryness and taken up by  $EtOH$  (Nessler and Barth) confirmed this. The sol. alkalinity of wines dropped to 0; in ciders it was almost the same as when detd. directly. These results, as yet carried out on only a small number of wines, lead to the hope that the exceptions to the method for the detection of cider in wines may be thereby eliminated. A wine with more than 1 g.  $K_2SO_4$  may be suspected of containing cider if the ratio exceeds 0.5. With less than 1 g.  $K_2SO_4$ , it does not generally exceed 1. Wines in which the sol. alkalinity is 0 may contain  $H_2SO_4$  or too much  $SO_2$ . F. F. HEYROTH

The acid of unripe grapes. G. MAGISTOCCHI. *Rev. fac. agro. vet. la Plata* 13, 62-88 (1918).—From the following analysis of juice of unripe grapes M. concluded that the malic acid present could well be used to displace the citric acid, amounting to over

\$4,000,000 imported and used each year to increase the acidity of wine produced from the ripe fruit: Total acidity, as  $H_2SO_4$ , 17.19; volatile acids, 0.776; reducing sugars, 75.0; ash, 3.12; alkalinity of ash, as  $K_2CO_3$ , 1.214; sulfates, as  $K_2SO_4$ , 1.266; chlorides, as  $NaCl$ , 0.351; phosphates, as  $P_2O_5$ , 0.086; Fe and Al, as  $Fe_2O_3$  and  $Al_2O_3$ , 0.336; Ca as  $CaO$ , 0.474; Mg, as  $MgO$ , 0.057;  $C_3H_5O_2K$ , 5.163; and malic acid, 20.452 expressed as %. 240 hectoliters of juice from immature grapes, with an acidity of 30% expressed as tartaric acid, were stored in cement vats, which were completely filled and hermetically sealed.  $H_2SO_4$  was added in large quantities. On April 15, just before the juice was used, it had the following compn.: sugars, 28%; acidity, as  $H_2SO_4$ , 19.3%; volatile acids, 0.35%; alcohol, trace; bacteria completely absent. The grape juice with which the above was mixed had an acidity of 2.90% and a density of 14.2° Bé. Sixty hectoliters of the ripe grape juice were dild. with 780 l. of green grape juice containing an acidity of 30%, equivalent to 23.5 kg. of tartaric acid. 50 casks and 1500 smaller containers of grape juice were similarly dild. with the juice of the green grapes. Fermentation proceeded normally and 10 days after emptying the last flask the reduction of the sugar was complete. Analysis of the wine was as follows: Alcohol by vol. 13.1%, reducing sugars, trace; acidity, as  $H_2SO_4$ , 4.25%; and volatile acids, 0.35%. After 7 months this had changed but little, mostly in acidity, which was reduced to 3.4%. Several smaller expts. in fermentation with grape juices dild. with green grape juice and powdered dry green grapes gave wines of normal characteristics and analysis. The expts. of various commercial companies are reported, who obtained similar results. Specific and detailed directions for gathering, drying and use of green grape powder and green grape juice are given.

R. B. DEEMER

**Control of fruit wines.** A. WIDMER. Wädenswil. *Schweiz. Apoth. Ztg.* 58, 681-5 (1920); 59, 4-9 (1921).—A critical review of existing practices, and an appeal for co-operation to restore purity and quality of com. fruit wines.

S. WALDBOTT

**Yeast.** J. EFFRONT. Brit. 160,496, Nov. 21, 1919. In prepg. yeast, the ordinary worts, prepd. from grain, manna, or rice saccharified by acid or malt, or from sugar, molasses, or beets are admixed with the products of extensive hydrolysis of albuminoids obtained by heating with HCl or other mineral acid at 106-108° for about 2 days, distillers' grains or the residues from the extrn. of oil from earth-nuts, soy beans, linseed, etc. The hydrolyzed liquid may, before neutralization, be used for saccharifying grain, etc., in prepg. the wort.

## 17—PHARMACEUTICAL CHEMISTRY

W. O. EMERY

**A stable vitamine product.** H. E. DUBIN AND M. J. LEWI. *Am. J. Med. Sci.* 159, 264-86 (1920); *Physiol. Abstracts* 5, 240; cf. *C. A.* 14, 3700.—The prepn. of a product, called "V," from maize, yeast, and orange juice is described, which is stated to contain all 3 vitamins, to be stable, and to be useful in expts. on animals and children. It is dried *in vacuo* at a low temp.; contains 10% of water. Analytical figures relating to Ca, P, N, fat, Fe, silicates, and phytin are given.

E. J. C.

**Liquid extract of red squill (*Scilla maritima*) as a rat poison.** F. W. SMITH. *Analyst* 46, 178-9 (1921).—Samples of the various squill rat poisons on the market, with extractives varying from 2 to 15%, differed in high degree with respect to toxicity, since out of 5 exts. examd. only 1 caused the death of a rat. The toxic effect of a dried aq. ext. prepd. from the dried official squill (*Scilla urguinea*) appeared to be nil when applied to rats. An alc. ext. made from the dried red squill proved effective. The easily

hydrolyzable toxic principle of squill, called scillitin, is a glucoside sparingly sol. in  $H_2O$ , but quite sol. in alc. From results obtained with aq., alc., and  $AcOH$  exts., it would appear that the glucoside most lethal to rats is present in greater quantity in the red squill. Other results suggest that preservation of exts. with salicylic acid can be effected without fear of destroying the toxic principle. Alc. should be employed, therefore, in prepg. the ext., the glucoside appearing to exist in the aq. liquid as the alc. is expelled. The whole of the toxic principle does not appear to be extd. with 90% alc., since the residual powder was more toxic than the alc. ext. W. O. E.

Estimation of strychnine in scale preparations containing quinine and other cinchona alkaloids. T.F. HARVEY AND S. BACK. *Analyst* 46, 188-93(1921).—The method giving the best results is a combination of the methods of Harrison and Gair (*Yearbook Pharm.*, 1903, 564) and of Simmonds (*C. A.* 8, 1847), the time required for the actual manipulation being about two and a half hours. In the case of an Fe, quinine and strychnine scale containing 15% quinine and 1% strychnine, dissolve 10 g. in 70 cc.  $H_2O$  in a beaker, 5 cc.  $N H_2SO_4$ , neutralize the whole with  $NH_3$  until the pptd. quinine only just redissolves. Add 30 g. Rochelle salt, neutralize the liquid with dil.  $NH_4OH$ , leaving the final reaction faintly acid to litmus. Stir the mixt. and heat in the  $H_2O$  bath for 15 min., cool and transfer to a 100 cc. measuring flask, rinsing the beaker with  $H_2O$  so as to make the vol. up to 100 cc. Let stand 2 hrs. and filter the liquid, rejecting the first 10 cc. Ext. 50 cc. of the filtrate 3 times with  $CHCl_3$  (using 30-, 10-) and 10-cc. portions, and  $NH_4OH$ , and wash the mixed  $CHCl_3$  solns. twice with 5 cc.  $H_2O$ . Shake the  $CHCl_3$  with 30 cc. of 10% (wt./vol.)  $H_2SO_4$ , and twice again with 10 cc. of the same acid, collecting the acid liquids in a small (60-cc.) separator previously plugged with a small piece of cotton. Add 5 cc. of freshly prepd. 4%  $K_4FeCy_6$  soln., then practically fill with 10% acid (to exclude air), and after rotation allow to stand 2 hrs. in a dark place. At the end of this time force the acid through the plug, wash the ppt. twice with 3 cc. of 5%  $H_2SO_4$ , then recover the strychnine by shaking with 10 cc. of 10%  $NH_4OH$ , and 15, 10 and 10 cc. of  $CHCl_3$ . Evap. in the usual way, adding towards the end about 3 drops of amyl alcohol to prevent decrepitation. Wash the cooled residue 3 times with 1 cc. of  $Et_2O$ , and dry at  $100^\circ$ . A correction of  $-1.7\%$  has been established for the vol. of the quinine tartrate in the foregoing procedure. Satisfactory recoveries are reported. The results of other expts. indicate that the presence of small quantities of either quinidine or cinchonine is not likely to introduce any material inaccuracy. In the event of the presence of quinicine which is pptd. along with strychnine, careful washing of the strychnine-quinicine mixture twice, with 0.5 cc. of acetone will eliminate the quinicine, provided no more than 20 mg. of this alkaloid is present. W. O. E.

Color reaction for aconite. S. MALLANNEH. *Analyst* 46, 193-4(1921).—A very delicate reaction, applicable not only to the pure alkaloid but also to the powdered root, consists in placing a minute particle of  $K_4Fe(CN)_6$  close to a minute portion of aconitine or a small portion of powdered root of aconite, then adding a drop of  $CO_2H_2$ , whereupon a green coloration immediately appears. This reaction is sensitive to  $1/1000$  grain of aconitine. Morphine, atropine, digitalin, strychnine, eserine and hyoscyamine do not react to this test, which therefore appears to be specific for aconite. W. O. E.

Influence of their reaction on the permanence of cocaine solutions. A. RIPPPEL. *Arch. Pharm.* 258, 287-95(1920); *J. Chem. Soc.* 120, I, 123.—Hydrolysis of cocaine by acids or alkalis occurs very readily, and is accompanied by a diminution of physiol. activity (Stockman, *J. Anat. Physiol.* 21, 46(1888)) which is also observed in aq. solns. when they are sterilized by heat. The activity of such solns. has now been measured by a comparison of them with solns. of known strength in the effect produced by their addition to a Ringer soln. supplied to a frog heart. Boiling for 1 hour in

neutral soln., or in a soln. of the same alkalinity as the blood, produced diminutions in activity of 60–70% and 80%, resp., but no deterioration occurred in solns. varying in acidity from  $p_H$  1 to  $p_H$  5.8. Similar, but less rapid, changes occurred at the ordinary temp.

W. O. E.

**Report on medicinal plants.** A. VIERHOEYER. *J. Assoc. Official Agr. Chemists* **4**, 409–15(1921); cf. *C. A.* **15**, 572.—The report is divided into 4 divisions: (1) Work concerning new sources of supplies or proper substitutes for drugs not now obtainable; (2) value of vol. wt. detns. in the analysis of crude drugs and spices; (3) value of microsublimation in the analysis of plant products; (4) condition of domestic and imported drugs. Under the first heading, work was done on Spanish digitalis, Egyptian henbane and *Rhoponticum* root. Recommendation is made that work be continued, to det. the value of a more extended use of vol. wt. detn. in the analysis of crude drugs and spices; that work be continued to find new sources of supplies or proper substitutes for drugs not now available; that the subject of sublimation for the analysis of plant products be further studied; that the methods for the macroscopic and microscopic identification of *Digitalis thapsi*, and *Hyoscyamus muticus* be adopted as tentative methods.

W. O. E.

**Report on alkaloids.** A. R. BLISS, JR. *J. Assoc. Official Agr. Chem.* **4**, 416–20 (1921).—Certain changes are recommended in methods for the assay of strychnine in tablets and elixirs. While recommendation is made that the methods for the sepn. of quinine and strychnine, and for the assay of physostigma be adopted as tentative, it is advised that they be subjected to further study. It is recommended that the assay for fluidextract of hyoscyamus of the U. S. P. be adopted with certain minor changes.

W. O. E.

**Report on balsams and gums.** E. H. GRANT. *J. Assoc. Official Agr. Chem.* **4**, 421(1921).—A method for the detn. of crude fiber in gum karaya was submitted to collaborative study, and the results obtained submitted in tabulated form. Further work on the method is recommended.

W. O. E.

**Turner reaction for gurjun balsam.** J. B. LUTHER. *J. Assoc. Official Agr. Chem.* **4**, 422–4(1921).—In using Turner's reaction for gurjun balsam in copaiba, a time limit of 10 seconds must be made on the appearance of a pink color, since all copaibas give more or less coloration after longer standing. A modified method offering several advantages is as follows: Dissolve 4 drops of the volatile oil in 1 mil glacial AcOH; add 1 drop of a freshly prepd. aq. soln. of  $\text{NaNO}_2$  (1:10) and then add at once, mixing quickly, 2 cc. of a 5% soln. by vol. of concd.  $\text{H}_2\text{SO}_4$  in glacial AcOH. Immediate formation of a violet color indicates the presence of gurjun.

W. O. E.

**Pharmacopeial assay for alcohols in santal oil to include the true acetyl value.** C. W. HARRISON. *J. Assoc. Official Agr. Chem.* **4**, 425–7(1921).—Results obtained on mixts. of santal oil with other vegetable oils show that it is possible to add appreciable amounts of foreign oils and still, when assayed via the U. S. P. method, have present apparently over 90% of alcohols calcd. as santalol. When the alcohols are calcd. from the true Ac value (obtained from the volatile acids distd. in a large-size modified Hortvet app.), however, this figure is materially reduced. The method followed is given in detail, as also the results obtained with oil mixts.

W. O. E.

**Volatile oil from the leaves of the "wild pimento" of Jamaica.** O. D. ROBERTS. *J. Soc. Chem. Ind.* **40**, 94–6T(1921).—The results of this investigation of the volatile oil from the leaves of *Amomis jamaicensis* show that its compn. is approx. as follows: terpenes inclusive of  $\alpha$ -phellandrene and dipentene 17.0%; cineole 15.0%; aldehydes 0.1%; alcs. chiefly *l*-linalool with some geraniol 38.3%; esters as linalyl acetate 1.5%; phenols undetd. 0.1%; acids (free acetic and caproic) 0.2%; residue probably contg. sesquiterpenes 27.8%.

W. O. E.



A cineole-containing herba thymi. R. WASICKY. *Pharm. Monatshefte* 2, 39-40 (1921).—A sample of thyme is described, having an odor not unlike oil of rosemary, but carrying little or no thymol. W. O. E.

Two new disinfectants containing aluminium. H. FRIEDENTHAL. *Pharm. Zig.* 66, 344-5(1921).—One of the preps., *allacdol*, appears to be the Al salt of the acid from kumiss (Milchweinsäure). In contact with H<sub>2</sub>O or animal liquids it disengages O over a considerable period. The other, *kavatal*, is obtained by fusing allactol with NaBO<sub>2</sub>. Both preps. form white powders readily sol. in aq. solns. and possess relatively high disinfectant properties. W. O. E.

Pelargonium oil. RICHARD KNUTH. *Am. J. Pharm.* 93, 302-15(1921).—Origin of the oil and classification and cultivation of the plant from which the oil is distd.

W. G. GAESSLER

The analytical characteristics of powdered talcum for use in toilet articles. GEORGE E. ÉWE. *Am. J. Pharm.* 93, 316-19(1921).—A description including fineness of subdivision, whiteness, adherence test, "pearliness," density, sifting quality, freedom from dampness, and chem. characteristics. W. G. GAESSLER

The volatilization of ethyl nitrite from sweet spirit of niter. J. G. ROBERTS. *Am. J. Pharm.* 93, 320-24(1921).—Expts. show that ethyl nitrite is easily dissipated from an alc. soln., that the action of direct sunlight is very destructive to it in flint glass containers, that partly filled containers are objectionable, and that it is bad practice to dispense numerous orders from the same container. The ideal method of storage is in small, completely filled, amber bottles, kept in a refrigerator or ice-box. W. G. GAESSLER

Determination of bismuth by formaldehyde. S. B. TALLANTYRE. *Am. J. Pharm.* 93, 344(1921).—T. calls attention to the applicability of the formaldehyde reduction process to the rapid estimation of bismuth in medicinal compds. as follows: The compd. or prep. is warmed with a small quantity of dil. HCl (about 10%) for a few mins. until it is decompd. and all the Bi is in soln. The mixt. can then usually be treated at once with a fair amt. of HCHO soln., then a good excess of 10% NaOH, warmed and finally boiled until the ppt. of Bi all seps. to the bottom of the soln. The supernatant liquid is now treated with more of the reagents and the whole again heated to boiling to make sure reduction is complete. The clear liquid can then be decanted or filtered off and the Bi either washed by decantation with hot, weak HCHO water or if it is not in a well coagulated condition, reboiled with a little more HCHO and NaOH solns. By stirring or pressing, the Bi collects into a spongy mass which is very easily removed to a tared filter, Gooch Crucible, or weighing bottle, washed with abs. alc. and weighed after drying an hr. or so at 105°. The ppt. is pure Bi produced according to the following reaction:  $2 \text{ Bi (OH)}_3 + 3 \text{ H.CHO} + 3 \text{ NaOH} = 2 \text{ Bi} + 3 \text{ HCO} - \text{ONa} + 6 \text{ H}_2\text{O}$ .

W. G. GAESSLER

Unguentum potassii iodidi, B. P. MISS J. FINDLATER. *Edinburgh. Chemist and Druggist* 94, 564(1921).—Adeps lanae, with a small quantity of soft paraffin, is recommended as a base. It takes up 50% of its wt. of H<sub>2</sub>O, and does not become rancid.

F. F. HEYROTH

The aromatic products of the Lyons district. R. M. GATTEFOSSÉ. *Chemist and Druggist* 94, 740(1921).—A short general discussion of the perfume industry.

F. F. HEYROTH

Testing of fluidextracts. HAINE. *Farm. Revy.* 1920, 480; *Schweiz. Apoth. Zig.* 59, 117-8(1921).—H. found the sp. gr. and ext. content of several samples of the most active fluidextracts of the Swedish Pharmacopeia to be: *Ext. Cinchonae fluidum*. Sp. gr., 1.102, 1.104, 1.096, 1.117, 1.119, 1.096, 1.1127, 1.107, 1.123. % ext., 35.6, 35, 32.6, 37.8, 32.3, 36.4, 33.5, 37.1, 35.8, 37.6. *Ext. Condurango fluidum*. Sp. gr., 1.034, 1.035, 1.024, 1.048, 1.019, 1.047, 1.320, 1.023. % ext., 19.6, 18.5, 17.6, 19.1, 16.4, 20.6,

18.2, 17.9. *Ext. Frangulae fluidum.* Sp. gr., 1.078, 1.062, 1.085, 1.073, 1.072, 1.081. % ext., 25.3, 22.4, 28.2, 26.4, 25.8, 27.6. *Ext. Hamamelidis fluidum.* Sp. gr., 1.087, 1.086, 1.088, 1.089, 1.071, 1.093. % ext., 27.8, 27.8, 25.6, 31.4, 26.4, 28.5. *Ext. Hydrastis fluidum.* Sp. gr., 1.022, 1.017, 1.021, 1.008, 1.036, 1.029. % ext., 32.9, 28.1, 29.2, 29.7, 31.9, 30.2. *Ext. Ipecacuanhae fluidum.* Sp. gr., 0.973, 0.975, 0.972, 0.981, 0.968, 0.958. % ext., 16.8, 14.4, 14.1, 16.2, 13.2, 12.3. *Ext. Rhamni Purshianae fluidum.* Sp. gr., 1.081, 1.066, 1.086, 1.104, 1.077, 1.094, 1.098, 1.069. % ext., 28.1, 30.4, 29.5, 33.2, 28.4, 32.9, 31.2, 28.6. *Ext. Secalis cornuti fluidum.* Sp. gr., 1.045, 1.062, 1.067, 1.056, 1.079, 1.072. % ext., 16.9, 16.8, 17.2, 16.4, 20.1, 18.1. The variations show that it would be better for the Swedish Pharmacopeia to give these values as limits rather than as definite figures. The best test of the quality of a fluidextract is the detn. of its ext. content.

F. F. HEYROTH

A new, practical, and rapid method for the determination of morphine in opium and in certain opium preparations. TRIFON UGARTE. Buenos Aires. *J. pharm. chim.* [7] 23, 129-31 (1921).—A rapid method for the assay of morphine, requiring but small amts. of material, and giving results with "perfectly acceptable precision", is described. To 1.0 g. powdered opium, weighed in a 200-cc. beaker, add 10 cc. 67% EtOH, and, after agitating 5 min. on a water bath, decant on to a filter, receiving the filtrate in a 7-cm. crystallizing dish, 2 cm. high. Repeat the EtOH treatment 3 times on the insol. residue in the beaker, and evap. the combined filtrates on the water bath. Keep the dried ext. 15 min. at 100° to render the resins insol. by oxidation. Add 5 cc. cold distd. H<sub>2</sub>O, scrape the sides of the dish with a flattened glass rod to suspend the insol. matter, and filter into a 200-cc. beaker. Repeat with 3 more 5-cc. portions of H<sub>2</sub>O, and evap. the 20 cc. combined filtrates on a water bath. Redissolve the residue in 2 cc. distd. H<sub>2</sub>O satd. with morphine (prepd. by shaking 0.5 g. morphine in 1 l. H<sub>2</sub>O 5 min., and allowing to clear). To the soln. add, with agitation, 3 cc. N NH<sub>4</sub>OH satd. with morphine (prepd. by shaking 0.2 g. morphine with 100 cc. N NH<sub>4</sub>OH 5 min., and allowing to clear); add immediately 10 cc. Et<sub>2</sub>O and shake. Add 20 cc. more Et<sub>2</sub>O to replace that lost by evapn., stir again, and let stand 30 min. for the formation of cryst. granules of morphine, clinging to the walls of the beaker. Decant the ethereal layer on two filters of the same wt., add 10 cc. more Et<sub>2</sub>O, stir, and wash the crystals on to the filter with the aid of a stream of water satd. with both Et<sub>2</sub>O and morphine. Dry the two filters at 100° and weigh; the difference in wts. indicates the amt. of morphine in 1.0 g. opium. In the case of tinctures and other opium preps., weigh 10 cc. in a crystg. dish, dry on a water bath, keep at 100° for 15 min. longer, and proceed as above.

F. F. HEYROTH

The preparation and preservation of adrenaline solutions. F. RICHARD AND M. MALMY. *J. pharm. chim.* [7] 23, 209-14 (1921).—The adoption of an official soln. of adrenaline (1:1000) is urged because of the great variations in the formulas of the solns. sold at present. Tests show that solns. made by the aid of SO<sub>2</sub> with physiol. salt soln. as base, are best; the SO<sub>2</sub> acts as solvent, antiseptic, and preservative. The adrenaline is dissolved in 100 cc. of physiological salt soln. (7.5 g. NaCl per l.) containing 10 g. SO<sub>2</sub> per l. (controlled by back titration with 0.1 N I<sub>2</sub>), and brought to 1000 cc. by the addition of sterilized physiol. salt soln. This soln., which gives 19.7 drops per g., must be made in the absence of NH<sub>3</sub> fumes which color it quickly. It may be preserved in filled, stoppered flasks, or better, in ampoules filled with great care in an atm. of CO<sub>2</sub>. Such ampoules have kept perfectly for a year, obviating the heat sterilization which quickly decomposes adrenaline.

F. F. HEYROTH

Contra-indication to a process for the detection of saccharin. L. THÉVENON. *J. pharm. chim.* [7] 23, 216 (1921); cf. C. A. 15, 999.—The reagents previously directed for the detection of saccharin are found to give the test described even in the absence

of saccharin; the method must, therefore, be discarded. Slight traces of  $\beta$ -naphthol can give an intense red color in a soln. of  $\text{NaNO}_2$  acidified by  $\text{HCl}$ . F. F. HEYROTH

**Need of the physiological control of adrenaline and of preparations of the suprarenal glands.** M. TIFFENBAU. *J. pharm. chim.* [7] 23, 313-7, 366-75(1921).—A plea for the physical, chemical, and biological control of adrenaline and its preps., based on the variable results noted on testing, by a modified U. S. P. method, 5 com. adrenalin, 4 adrenaline solns., and 5 preps. of the suprarenal glands. F. F. HEYROTH

**Pituitary standardization.** G. TARR. Univ. College, India. *Pharm. J.* [4] 52, 268-9(1921).—The difficulties met in selecting a standard are cited. Cf. *C. A.* 6, 3494; 7, 156; 8, 3344; 9, 2286. Different lots of U. S. P. histamine standard may vary in activity. Histamine is depressant to the rat uterus, while infundibular ext. is stimulant. Autolytic and bacterial changes in the slaughter houses might be detected by the use of a standard with the same action on the rat uterus as infundibular ext. In the excized uterus test on the virgin guinea pig, it was found that the results are changed by variations in the proportions of K and Ca in the Locke soln. used; regular increases in contractions were obtained by increasing the amt. of KCl. Infundibular exts. deteriorate too quickly in the tropics to be employed as standards; samples sent out in March, 1920, and in Sept., 1920, had deteriorated to the same extent (30%) by Feb., 1921. The remaining activity was shown by tests on the rat uterus to be due to pituitrin and not histamine. The amt. of 1.5% KCl soln. which had to be added to 60 cc. Locke soln. to produce a submaximal contraction of a portion of excized virgin guinea pig uterus was found to be 10 times the amt. of 1:200 infundibular soln. required to produce the same effect. The ratio is the same with different uteri, although different amts. can be used. The same amt. of KCl is required to produce equal contractions whether in 1.5% or in 15% solns. The latter is more convenient, as the amts. are the same as the amt. of infundibular ext. soln. to produce the same results. If more of the ext. soln. than of 15% KCl soln. is required to produce the same submaximal contraction, then the ext. is below standard. The same applies to the excized uterus of the virgin rat. An excess of  $\text{CaCl}_2$  in the Locke soln. antagonizes the KCl. The contraction produced by KCl has slightly less wt.-lifting power than that due to infundibular ext. F. F. HEYROTH

**History of opium.** AXEL JERMSTAD. *Schweiz. Apoth. Ztg.* 59, 26-29, 34-6, 50-4, 69-72, 85-9(1921); cf. *C. A.* 13, 2733.—The history of opium preps. employed by Greek, Arabian, and later physicians is discussed in detail. F. F. HEYROTH

**Analysis of the remains in a Gallo-Roman vase.** L. REUTTER. Geneva. *Schweiz. Apoth. Ztg.* 59, 233-5(1921).—An analysis was made of a 2.5 g. mass, brown-black and yellow-brown in different places, obtained from a vase found in excavations conducted by Dr. Baudoin in Vendee. It was odorless, with a slight balsamic taste, and when rubbed gave a yellow-brown powder with a lightly balsamic odor. It is concluded to have been a mixt. of incense (olibanum), turpentine, storax, and styrax, with an aromatic wine and an oil, contg. oils of rose and geranium, and possibly of thyme and mint. F. F. HEYROTH

**Essential oil of *Boronia pinnata*, Sm., and the presence of elemicin.** H. G. SMITH. *Proc. Roy. Soc. Victoria* 32, 14-9(1919); *Physiol. Abstracts* 5, 257.—An account is given of the chem. and physical consts. of elemicin, now for the first time extd. from *Boronia*, the oil of which it forms 75%. E. H.

**Crystallization of acetylsalicylic acid.** G. CAPPELLI. *Giorn. chim. ind. applicata* 2, 379-80(1920).—Conclusions: (1) It is inadvisable to crystallize acetylsalicylic acid from  $\text{H}_2\text{O}$ , because, although a product is obtained very similar to the patented material, yet it absorbs so much  $\text{H}_2\text{O}$  as to cause a lowering of the m. p. by  $6^\circ$ , and to induce a partial sapon. (2)  $\text{CHCl}_3$  and  $\text{Me}_2\text{CO}$  are not the best solvents for crystn., because

the crystd. products obtained from them are chiefly composed of lusterless needles and plates. (3) The most appropriate solvents are  $C_6H_6$  and  $CCl_4$ . To obtain a product crystd. in soft brilliant plates, employ very pure crude acetylsalicylic acid free of salicylic acid, and agitate the soln. very slowly while cryst. (4) When the crude acetylsalicylic acid contains even slight traces of salicylic acid, repeated crystns. with these solvents are necessary, not only for purification, but because, otherwise, the crystals obtained are lusterless.

ROBERT S. POSMONTIER

**Extracts prepared according to the official Italian pharmacopeia.** II. BERNARDO ODDO. *Giorn. chim. ind. applicata* 2, 381-7(1920); cf. C. A. 14, 1408.—This study takes up the following: (1) Ethereal ext. of male fern (*filix mas*); (2) hydroalcoholic ext. of pomegranate (*granato*); (3) hydroalcoholic ext. of spurred rye (*secale cornuto*). Details of methods of prepn. are given and also qual. and quant. tests of their proximate constituents.

ROBERT S. POSMONTIER

**Essence of lemon extracted in presence of water.** P. LEONE. *Giorn. chim. ind. applicata* 2, 617-9(1920).—In the extn. of lemon essence from rinds of lemons a mechanical method has recently been applied, in which running water is used to ext. the essence, where formerly the extn. was done by hand, by pressing sponges against the surface of the lemon without the use of water. L. sought to discover the effect upon the quality of the ext. of the use of water in the large quantities necessitated by the new method. The criterion of a good essence of lemon is the amt. of citral present in it, the citral being the principal odoriferous component of the essence. Citral should be present to an extent not less than 4% (40% in a deterpinated essence) in a good essence. L. agitated lemon rinds with water in various amts. and drew the following conclusions from these expts. (1) The use of water in large amts. in intimate contact with essence of lemon, as occurs in the recent process of extn. of essence in presence of water, brings about a decrease in the amt. of citral in the essence, and consequently a lower sp. gr. and higher optical rotation of the essence. Essences thus prepd. may be considered impure if judged by the criteria of sp. gr. and the minimum amt. of citral permitted. (2) These prejudicial results may be obviated almost completely, if instead of pure water there is used water which has been employed in previous extns.

ROBERT S. POSMONTIER

**Influence of the manner of storage on the pharmacological activity of digitalis.** JOHN GRÖNBERG. *Finska Apotekareföreningens Tid.* 1919, 192-3.—Digitalis should be stored in stoppered glass bottles, kept in a dark place and containing not over 1.5% moisture when put away. The storage should begin as soon as possible after the leaves have been gathered. The leaves should be coarsely ground. The important consideration is to keep them dry. These conclusions are based on a series of expts. covering several years in which the following facts were noted. The potency of the drug decreased in 8 months 27.5% when the moisture was 5.6% and over 35% when the  $H_2O$  was 10%. Leaves with a moisture content of 1.3% stored in stoppered glass containers lost 7-14%, whereas the leaves kept in wood, tin or paper boxes lost 20-30% of their activity. If the glass was left loosely covered and in light places the loss amounted to 28%. Digitalis leaves with a moisture content of 1.5% when stored in tightly stoppered glass bottles and kept in the dark lost 2-9% of their pharmacol. activity in 2 to 4 years.

A. R. ROSE

**Determination of morphine in opium.** AXEL JERMSTAD. *Arch. Pharm. Chem.* 28, 187-8(1921).—The minute details in the detn. are given. The general principles are published as a dissertation from Basel and in a Swiss journal (C. A. 14, 3123).

A. R. ROSE

**Determination of alkaloids in cinchona bark.** SVEND AAGE SCHON. *Arch. Pharm. Chem.* 28, 93-9(1921).—Gravimetric and volumetric methods for the detn. of alkaloids

in cinchona bark are compared. Two types of analysis are about evenly favored in the world's pharmacopeias. From S's tables it would appear that the Fromme method (volumetric) and the gravimetric method (Dan. Pharm., U. S. P.) give results which agree very well. In using the Dan. Pharm. procedure the correction should be made for  $H_2O$  (cf. Hille, Arch. Pharm., 241, 54). He assumes that Flüger's method is reliable and uses this as the basis for his comparisons. Some other volumetric methods (e. g. Katz) are not trustworthy.

A. R. ROSE

**Phenol coefficients.** F. W. TILLEY. *Am. J. Pub. Health* 11, 513-9(1921).—The origin of the phenol coeff. method of detg. the value of a disinfectant is reviewed. The errors and limitations of the various procedures are discussed. The author asks why it is reasonable to make such detns. when they are scarcely ever used by those who use disinfectants. The abandonment of the phenol coeff. is advised and it is proposed that manufacturers be required to test their compds. on organisms mentioned in the literature accompanying the disinfectant. A guarantee that the compd. is potent under natural conditions and in dilns. recommended would be worth more than the phenol coeff.

F. W. T.

**Constituents of the root of *Rumex crispus* L. var. *japonicus* Makino.** IL. Y. MURAYAMA AND T. ITAGAKI. *J. Pharm. Soc. Japan* 470, 327-30(1921).—In part I, (*Ibid* 93(1913)), M. identified crysophanic acid and certain emodin-like substances in the root of *Rumex crispus* L. var. *japonicus* Mak. (*Rumex japonicus* Meisn.). The nature of this emodin-like substance is now reported. The roots were collected during July from the neighborhood of Tokyo, and sun-dried. An alc. ext. was prepd. From the  $H_2O$ -insol. fraction of this ext. and  $H_2O$ -insol. fraction of hydrolytic product of the  $H_2O$ -sol. portion of the alc. ext., M. and I. isolated 0.5% of crysophanic acid and 0.12% of emodin. The emodin,  $C_{15}H_{10}O_5$ , was red-orange needle cryst., m. 253°. From the m. p. it probably corresponds to frangula-emodin. Since the crysophanic acid, prepd. by M. and I. contained about 3.11% of methoxyl, it is probably mixed with an impurity contg. methoxyl compds. such as emodin monomethyl ether.

S. T.

**Stability of chloramine antiseptics.** JULIUS BEBIE. *J. Am. Pharm. Assoc.* 9, 974-9(1920).—The products studied were protected from undue action of light and heat while under observation. In order to insure the greatest degree of stability for chloramine-T, dichloramine-T and halazone, these products should be produced of a high degree of purity. From observations extending over one year, chloramine-T may be considered stable in crystal form and in aq. solu. either alone or in mixt. with NaCl,  $Na_2CO_3$  or  $NaHCO_3$ . In amorphous form dichloramine-T begins to deteriorate after 3 months. The crystal compound product is stable for about 8 months and is only slightly decompd. in 14 months. An exceptionally pure specimen showed no deterioration after 14 months' storage. Solns. of dichloramine-T in chloroform of 2 1/2 to 5 % strength, if dried by  $CaCl_2$ , are stable for about 2 weeks. Solns. in  $CCl_4$  of 11 % strength were stable during an observation of 8 months. Halazone is fairly stable, having been stored for 1 year without serious decompn.

L. E. WARREN

**The chemistry of the heptane solution.** E. KREMERS AND D. C. L. SHERK. *J. Am. Pharm. Assoc.* 9, 1042-52, 1153-63(1920); cf. C. A. 15, 730.—A specimen of 48 l. of com. oil of *Pinus jefferyi* was fractionated with a loss of 2%. The distillates were refracted with steam and collected in lots of about one l. each, 36 l. being obtained. The d. of each fraction was taken at 22°. The values found for the first 25 fractions ranged between 0.682 and 0.683. After this the d. rose to 0.858 for the last fraction. Tests for aldehydes were negative. The distillates were neutral to litmus. The second fractions were purified by various reagents, including I, HI, HCl,  $SbCl_3$  and Br + HBr. The b. p. of the main portions of the fractional distillates after purification were remarkably uniform, the value being 98.34° corr. The  $d_{20}$  of the

purified fractions lay between 0.68459 and 0.68488. The  $n_D$  varied from 1.38737 to 1.38740. The viscosity as compared with water varied from 0.413 to 0.417.

L. E. WARREN

**The essence extracted from the berries of *Juniperus phoenicea* L. of Sardinia.** E. RUXDDU AND F. VODRETT. Univ. Cagliari. *Gazz. chim. ital.* 50, II, 245-57(1920).—The existing knowledge of the essential oils of various species of junipers is reviewed. The 5 species reviewed contain pinene, cadinene, cedrene, pino-limonene, etc. Rodie (C. A. 1, 86, 2400) studied the essence of *J. phoenicea* obtained from flowerless twigs without berries and found the terpene fraction to be 92.3% of the whole, and mostly pinene. He also obtained camphene and phellandrene. (Schimmel & Co., *Bull.* 11, 46(1895)) found in *J. phoenicea* 75% pinene, some cadinene but excluded camphene. The berries examd. by P. and V. were obtained from Domus de Maria and da Teulada. The essential oil was extd. by distg. the berries with direct heat with and without previous maceration. Four procedures are described in which 10 kg. of berries were heated with 20 to 23 l.  $H_2O$  and gave 1.60 to 2.50% yields of the essential oil. The best yield was obtained when the berries were allowed to macerate in  $H_2O$  at least 2 days. The essence freshly distd. is transparent, colorless and clear and yellows by the action of light. It has a pleasant aromatic odor and rubbed on the hands has the odor of turpentine. The  $d_{15}$  varied from 0.8718 to 0.8731, dried over  $Na_2SO_4$ ,  $d_{15}$  0.8658,  $[\alpha]_{15}^{20}$  16.84,  $n_D^{20}$  1.47259, is insol. in 70 or 80% EtOH but dissolves 1.16 in 90% EtOH at 27°,  $n_D$  1.4675, sapon. no. 14-15, acid no. 2.49, ether index 12.01, Ac. no. 35. 2 cc. give no aldehyde reaction with 5 cc. of Schiff reagent after 24 hrs. The I no. is 285.53 by Huerre's modification of Hübl's method (C. A. 14, 92) which P. and V. found gives more const. results. The Br no. was 264.55 as detd. by the Benedikt-Ulzer method. 5% Br in  $CHCl_3$  soln. added to the essence was decolorized at first and then gave a stable olive-green color. 5% I in petr. ether was decolorized by the essence at first and then gave an orange-red color, then ruby-red. HCl in  $CHCl_3$  gave differently colored layers; upper violet-brown, lower orange-yellow. Concd.  $H_2SO_4$  gave a red-brown color. Concd.  $H_2SO_4$  +  $FeCl_3$  gave a yellow-brown color. 100 cc. were fractionated at 70 mm: (1) 27.0 g. b. 120-2°, colorless; (2) 30.5 g. b. 122°, colorless; (3) 11.0 g. b. 123-31°, colorless; (4) 4.4 g. b. 132-57°, yellowish; (5) 11.3 g. b. 158-98°, greenish yellow. 1, 2 and 3 were mixed and again fractionated at 30 mm: (1) 49.5 g. b. 75-80°, transparent and odorless; (2) b. 81-92°, yellowish. (1) was again fractionated and that passing at 74° (36.8 g.) showed  $d_{15}$  0.8543;  $n_D$  1.4644,  $[\alpha]_{15}^{20}$  23.94°. The remaining data will be given in a subsequent paper. E. J. W.

Estimation of ethyl acetoacetate (YANAGISAWA, KAMIO) 7.

ARNY, HENRY V.: *Principles of Pharmacy*. 2nd Ed. revized. Philadelphia: W. B. Saunders Co. 1056 pp. For review see *Pharm. Weekblad* 58, 707(1921).

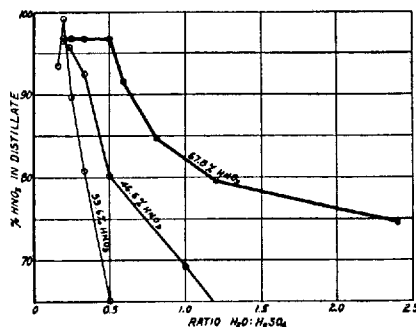
**Useful Drugs.** 4th Ed. Chicago: American Medical Association. 76 pp. For review see *Expt. Sta. Record* 43, 580(1920).

## 18—ACIDS, ALKALIES, SALTS AND SUNDRIES

F. C. ZEISBERG

**Elements of the high concentration of nitric acid.** ERNST GALLE. *Z. angew. Chem.* 34, Aufsatzteil 168-70, 173-5(1921).—The literature on properties of nitric acid-water and nitric acid-sulfuric acid-water mixtures is reviewed. (The very extensive work of Pascal, cf. C. A. 12, 295, 2664; 13, 3049; 14, 1007, is overlooked.) The Pauling

process of concg. nitric acid, as improved by Hoenig, is described, with an illustration. Expts. carried out by G. showed that when boiling off half of a 33.5%  $\text{HNO}_3$  soln. in a distg. flask, the  $\text{HNO}_3$  content of the distillate increased gradually from 1.3 to 6.8%. The av. compn. of the distillate was 2.82%  $\text{HNO}_3$  and that of the residue 64.2%. The flask was then fitted with a bead-filled Hempel column,  $40 \times 4$  cm., and the expt. repeated. The distillate contained an av. of 0.044%  $\text{HNO}_3$  and the residue 64.1%.



was necessary to obtain a distillate of given strength. It is also concluded that preconcn. of the weak nitric acid to 42° Bé. (67%  $\text{HNO}_3$ ), without the addition of sulfuric acid, is necessary if the super-concn., i. e., high concn. with sulfuric acid, is to be economically carried out on the manufacturing scale.

F. C. Z.

**Remarks on apparatus for cooling sulfuric acid.** GIUSEPPE GIANOLI. *Giorn. chim. ind. applicata* 2, 439-41(1920).—G. suggests certain changes in the disposition of the usual app. for cooling the  $\text{H}_2\text{SO}_4$  coming from the Glover tower, in order to decrease the amt. of water necessary for cooling. A sketch of the change in app. is given.

ROBERT S. POSMONTIER

**The industry of alkalies. I. The world's potassium problem.** M. GIUA. *Ann. chim. sci. ind.* 37, 14-40(1921).—A review.

EUGENE FIERTZ

**The synthesis of ammonia at Oppau.** F. LEFÈVRE. *Industrie chimique* 8, 44-6, 86-9, 122-3(1921).—A description of the process and plant.

A. P.-C.

**Manufacture of hydrogen for ammonia synthesis.** G. CLAUDE. *Compt. rend.* 172, 974-7(1921); cf. *C. A.* 15, 1377.—The installation of the Claude ammonia process in proper sized units in connection with plants producing  $\text{H}_2$  as a by-product is advocated. The cost of special  $\text{H}_2$  plants is obviated. The sepn. of  $\text{H}_2$  from water gas, coke oven gas or other coal gases is proposed by washing the gas at low temps. and under pressure for the removal of constituents other than  $\text{H}_2$ . Detns. of soly. of  $\text{CO}$ ,  $\text{H}_2$  and mixts. of the two in various org. solvents between 20° and -160° and between 1 and 1800 atms. are reported as having been made; the results obtained with  $\text{Et}_2\text{O}$  as the solvent are given. The soly. of either gas is greatly influenced by the presence of the other. Under 350 atms. of  $\text{CO}$ , 20 cc. of ether disappear from the liquid phase, vessel capacity 150 cc. (temp. not given); the presence of  $\text{H}_2$  necessitates much greater pressures. The industrial sepn. of  $\text{H}_2$  contg. less than  $1/1000$  of  $\text{CO}$ , from a mixt. of the 2 gases by the use of ether as the solvent at about 100 atms. and -50°, is asserted.

R. L. B.

**Salt manufacturing processes.** TSUTOMU MAEDA. *J. Chem. Ind. Japan* 23, 1129-46(1920).—The isothermal evapn. of sea water was studied by phase rule at 25° and 105°. The conditions for manufacturing salt from sea water by solar evapn. and direct boiling were analyzed. Sea water collected at Gankai, Japan, contained Na 1.0110%, K

0.0375%, Mg 0.1213%, Ca 0.0414%, Cl 1.8330%,  $\text{SO}_4$  0.2517%; or sodium chloride (calcd. as  $\text{Na}_2\text{Cl}_2$ ) 2.5680%, potassium chloride (as  $\text{K}_2\text{Cl}_2$ ) 0.0715%,  $\text{MgCl}_2$  0.3240%,  $\text{MgSO}_4$  0.1912%,  $\text{CaSO}_4$  0.1406%, and total salt 3.296%. For detg. the intersection point of  $\text{CaSO}_4$ , artificial sea waters containing exactly the same proportion of all the other salts without  $\text{CaSO}_4$ , and made up in various multiple concns. of the original, were treated with  $\text{CaSO}_4$  at  $25^\circ$ , and the amts. of the salt necessary for satn. were detd. The same method was used for the pptg. points of the other salts at  $25^\circ$  and  $105^\circ$ . The results are shown in 9 tables and 7 charts. By representing the normal sea water concn. by  $n$ , the following figures were obtained for  $25^\circ$ .

Composition of liquid phase in mols. per 1000 mols.  $\text{H}_2\text{O}$ .

$n$	Pptd. salt	$\text{Na}_2\text{Cl}_2$	$\text{K}_2\text{Cl}_2$	$\text{MgCl}_2$	$\text{MgSO}_4$	$\text{CaSO}_4$
1.	none	4.093	0.0893	0.6337	0.2937	0.1924
3.55	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	14.53	0.3170	2.250	1.050	0.6830
11.25	$\text{NaCl}$	46.05	1.005	7.129	3.327	Ca. 0.2
60.80	$\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$	15.08	.....	38.71	18.00	.....

In order to concentrate sea water from  $n = 1$  to  $n = 3.5$ , 718.3 mols.  $\text{H}_2\text{O}$  must be evapd.; from  $n = 3.5$  to  $n = 11.25$ , 192.5 mols.; from  $n = 11.25$  to  $n = 60.8$ , 72.51 mols. At the first point 0.1746 mol.  $\text{CaSO}_4$  will come down; at the second 3.846 mol.  $\text{Na}_2\text{Cl}_2$  (93.97% of total  $\text{NaCl}$  in sea water) will be pptd., at  $25^\circ$ . With direct boiling it was found that the salt first coming out at  $100^\circ$  is a double salt containing Ca, Na and  $\text{SO}_4$  and  $\text{CaSO}_4 \cdot \text{Na}_2\text{SO}_4$  (glauconite) and this ppts. between  $n = 3.0$  and  $n = 3.5$ .  $\text{NaCl}$  comes down at  $n = 12.55$ . At  $n = 34.47$ ,  $2\text{Na}_2\text{SO}_4 \cdot 2\text{MgSO}_4 \cdot 5\text{H}_2\text{O}$  ppts. out. Unlike evapn. at  $25^\circ$  (solar evapn.) only 72.49% of the  $\text{NaCl}$  ppts. out at  $105^\circ$ , with direct boiling.

S. T.

Sources and composition of American potash. J. W. TURRENTINE. *Bur. Soils, Wash., D. C. Am. Fertilizer* 54, 93, 96, 100, 102, 104 (1921).—A review. W. H. R.

The Alsatian potash district. PIERRE DE RETZ. *Union des soc. ind. France troisième Congres Mulhouse* 1920, 71–98.—A review and discussion of the potash situation in Alsace before, during and after the war, of the compn. of the  $\text{K}_2\text{O}$  salts in the Alsatian deposits and of the methods of mining and refining the salts, together with statistical data on the use and consumption of  $\text{K}_2\text{O}$  throughout the world. W. H. ROSS

The Haber process at Merseburg (Saxony). J. R. PARTINGTON. *J. Soc. Chem. Ind.* 40, 144R (1921).—The Haber process carried out at Merseburg differs from that at Oppau (*C. A.* 15, 2156) in that the mixt. of N and H is made directly by treating a mixt. of producer gas and water gas with the addition of steam; and in that the purified mixt. of N and H before passing to the main catalyst furnaces is passed through a series of small catalyst furnaces to remove impurities. W. H. ROSS

Labelling concentrated solutions of hydrogen peroxide. ANON. *Oesterr. Chem. Zig.* 24, 17 (1921).—A discussion of misunderstandings arising from improper or ambiguous labelling of  $\text{H}_2\text{O}_2$  in general, and of concd.  $\text{H}_2\text{O}_2$  in particular. It is suggested, for example, that the expression: " $\text{H}_2\text{O}_2$  concd. 30% by wt." can only mean that 1 kg. of such soln. contains 300 g.  $\text{H}_2\text{O}_2$ ; that " $\text{H}_2\text{O}_2$  concd. 30% by vol." likewise can only signify that 1 liter of such soln. contains 300 g.  $\text{H}_2\text{O}_2$ , the first expression being applied for the most part to the medicinal, the second to the technical commodity.

W. O. E.

The production of helium. C. B. SCHWEIZ. *Apoth. Zig.* 59, 20–2 (1921).—Historical.

F. F. HEYROTH

Processes for production of hydrogen for airships in Germany during the war. GINO GALLO. *Giorn. chim. ind. applicata* 2, 443–9 (1920).—Review.

ROBERT S. POSMONTIER



**Casein.** CLARK MARION. *Paper Ind.* 3, 115-8(1921); *Paper* 28, No. 7, 30-3 (1921); *Paper Trade J.* 72, No. 16, 231-5(1921).—A description of the methods of prepn. and of the common tests of casein. H. H. HARRISON

Helium-bearing natural gas (ROGERS) 8. Determination of sulfur dioxide and sulfur trioxide in sulfur burner gases (DIECKMANN) 7. Catalytic reactions; hydrogen (Brit. pat. 160,466) 13.

**Ammonia.** G. P. GUIGNARD. Brit. 160,454, Feb. 14, 1921. Ti, N compds. such as the nitride of Ti cyanogen compds. are treated with H<sub>2</sub>O vapor with or without O under reduced pressure and at a temp. below 500°, the NH<sub>3</sub>, etc., produced being withdrawn as soon as possible. The gases withdrawn are passed through milk of lime or an alk. soln. in the cold to obtain NH<sub>3</sub> and a cyanide, or hot to obtain NH<sub>3</sub> and a formate which may be heated to obtain HCHO.

**Hydroxides; ammonium salts.** M. BUCHNER. Brit. 16,597, Nov. 24, 1915. Al(OH)<sub>3</sub> and other hydroxides are obtained by treating a pure or crude salt such as Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> in solid or fused form or in satd. soln. with an excess of strong NH<sub>4</sub>OH, the NH<sub>4</sub> salt soln. being drawn off and used again either by adding more NH<sub>4</sub>OH and using it as the precipitant or by using it to treat more salt and then adding further NH<sub>4</sub>OH. The NH<sub>4</sub>OH may be added to the salt or *vice versa*. The NH<sub>4</sub>OH and the salt may be on opposite sides of a porous partition, in which case the process may be continuous. Cf. 15,854, 1914 (C. A. 10, 96).

**Sodium bicarbonate; ammonium chloride.** L'AIR LIQUIDE, SOC. ANON. POUR L'ETUDE L'EXPLOITATION DES PROCÉDÉS C. CLAUDE. Brit. 160,172, March 15, 1921. In a modified ammonia-soda process, salt and gaseous NH<sub>3</sub> are dissolved in a mother liquor containing (NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub> and NH<sub>4</sub>Cl, and CO<sub>2</sub>, preferably pure and under pressure, is passed into the liquor until NaHCO<sub>3</sub> equiv. in quantity to the salt and NH<sub>3</sub> added, is pptd. The carbonating app. is provided with stirring means, *e. g.* of the Boulouvard type, and also with a cooling system. Although the salt must be dissolved separately it is advantageous to add some during the carbonation. The NaHCO<sub>3</sub> is removed and washed and the mother liquor, after the addition of NH<sub>3</sub> to convert the NH<sub>4</sub>HCO<sub>3</sub> present to carbonate, is run to crystallizers fitted with stirrers and cooling coils. NH<sub>4</sub>Cl is sepd. at atm. temp. or at 5-10°, and the washing water, etc., having been added to the liquor to maintain its initial vol., the whole process is repeated. Alternatively, a soln. of NH<sub>4</sub>HCO<sub>3</sub> prepd. from wash water by means of NH<sub>3</sub> and CO<sub>2</sub>, may be added to the saline soln. of (NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>, instead of satd., successively with NH<sub>3</sub> and CO<sub>2</sub>. Cf. 131,870 (C. A. 14, 319).

**Carbon.** F. C. DYCHE-TEAGUE. Brit. 160,561, Dec. 23, 1919. Pure C is obtained from crude material, such as coke, by oxidizing it to CO, passing the gas over a catalytic material so that CO<sub>2</sub> is formed and C deposited, and then sepg. the catalyst from the C by magnetic or gravitational means. CO formed from coke in the heated chamber passes through a porous fire-brick screen into the chamber containing finely divided Fe or other catalyst. The CO<sub>2</sub> may be passed back into the chamber for reduction to CO.

**Catalytic iron.** NITRO-FIXATION SYNDICATE, LTD. and H. C. JENKINS. Brit. 159,960, Dec. 5, 1919. Pure Fe, which is useful as a catalyst for the synthesis of NH<sub>3</sub>, is prepd. by treating ferric nitrate soln. with just sufficient AgNO<sub>3</sub> to ppt. any chloride present, filtering, evapg. the soln. to dryness, partially converting the nitrate into oxide by gentle ignition, washing out the residual nitrate together with any oxidized S product, and finally reducing the Fe<sub>2</sub>O<sub>3</sub>. An inert support, such as pumice or asbestos, may be added just prior to ignition; and a promotor may be incorporated with

the catalyst by adding  $\text{NH}_4$  molybdate, K osmate, Ti nitrate, or an alkali tungstate, to the purified  $\text{Fe}_2\text{O}_3$  before reduction. The product is preferably heated in pure  $\text{NH}_3$  gas. Cf. 19,249, 1910 (C. A. 6, 1346); 5833, 1911 (C. A. 6, 2500); 24,657, 1911 (C. A. 7, 404) and 25,252, 1911 (C. A. 7, 1589).

## 19—GLASS, CLAY PRODUCTS, REFRACTORIES AND ENAMELED METALS

G. E. BARTON, C. H. KERR

**Annealing temperature of glass.** F. WEIDERT AND G. BERNDT. *Z. tech. Phys.* 1, 51-8(1920).—The annealing temp. of a glass may be detd. by measuring the difference between the refractive indices of the ordinary and extraordinary rays of light passed through the glass before and after cooling from various temps. between  $200^\circ$  and  $600^\circ$ , and plotting this difference against the temp. of the glass before cooling. The graph so produced is a hyperbolic curve with a sharp bend at the annealing temp. This point is independent of the size of the specimen and of the rate of cooling within wide limits. The deformation temp. (i. e., the temp. at which a 25-mm. cube set on one of its corners on a specimen of the polished glass and half embedded in kieselguhr makes an appreciable impression on the glass after 6 hrs. heating) is about  $30^\circ$  below the temp. at which two plates of the glass permanently cohere, and  $40$ – $50^\circ$  higher than the annealing temp. of flint glasses and  $70$ – $100^\circ$  higher than the annealing temp. of crown and Ba glasses made at the Sendling works. The deformation temp. of a glass is characteristic, but is also a function of the duration of the heating and of the size of the specimen. J. C. S. I.

**Dispersion in optical glasses.** F. E. WRIGHT. *J. Optical Soc. Am.* 4, 148-59(1920); *Science Abstracts* 23A, 500; cf. C. A. 14, 3135.—Shows that for 316 types of silicate optical glass, if either of the partial dispersions  $n_F - n_D$  or  $n_G - n_F$  are plotted as ordinates against  $n_D - n_A$  as abscissas, the results lie in each case on a straight line (within a unit on the fourth place of decimals). This means that, for all such glasses, once a partial dispersion is given, the entire dispersion curve is fixed irrespective of the glass type. Hence if any partial dispersion is given, all other dispersions follow automatically and a change in dispersion at one part of the dispersion curve carries with it definite changes in the curve throughout the visible spectrum. Thus a series of standard dispersion curves can be set up independent of the abs. refractive index. This means that if, for any substance, two refractive indices are given, the dispersion curve can be written down at once; further, that in case two substances of very different indices are found to have the same actual dispersion for one part of the spectrum, their dispersion curves are identical, to one or two units in the fourth decimal place, throughout the visible spectrum. From these relations it is possible to build up dispersion formulas contg. 2, 3, or more consts. which represent the data in the visible spectrum with a high degree of accuracy. Certain of these formulas are of such form that they are valid far into the infra-red and ultra-violet, but break down of necessity as an absorption band is approached. Certain of the dispersion formulas thus obtained are well adapted for computation purposes. E. J. C.

**The 'why' of aging clay.** H. SPURRIER. *J. Am. Ceram. Soc.* 4, 113-8(1921).—Pugged clay evolved  $\text{CO}_2$  continuously for over 34 days and more rapidly at  $80$ – $90^\circ$  F than at lower temps. The plasticity, as indicated by the viscosity of slip made from the clay, increased at the same time. Org. liquids and acids did not develop plasticity in Edgar plastic kaolin. Addition of  $\text{H}_2\text{O}_2$  to clay slip stimulated a growth of green algae with evolution of CO and  $\text{CO}_2$  and a marked increase in the viscosity of the slip.

S. attributes the increase in plasticity with aging to the growth of such algae. Three clays were treated with KOH soln. and the ratio of  $\text{Al}_2\text{O}_3$ :  $\text{SiO}_2$  was detd. This ratio was 2.17 for Cooley ball clay, 1.009 for Edgar kaolin, and 0.35 for Harris kaolin. The plasticities of these clays stand in the same order as these ratios, and the detn. of this ratio is suggested as a simple means of differentiating clays. J. S. LAIRD

A study of spalling. R. M. HOWE AND R. F. FERGUSON. *J. Am. Ceram. Soc.* 4, 32-46(1921).—Air and  $\text{H}_2\text{O}$  quenching were compared and checked against results in service. One end of each brick was heated for 1 hr. at  $950^\circ$  and quenched in  $\text{H}_2\text{O}$  or subjected to air blast. On brick made from the same kind of clay the two tests gave comparable results agreeing with service results. Brick from different clays gave unsatisfactory comparisons unless the bricks were reheated to a high temp. before testing. Lamination in brick caused failure from spalling. Bricks of coarse ground materials and soft burned were more resistant than brick from the same clays finely ground or hard burned. J. S. LAIRD

Tests of fire brick made from ganister, flint clay, and plastic clay mixtures with special reference to spalling. R. M. HOWE AND M. SHEPPARD. *J. Am. Ceram. Soc.* 4, 206-12(1921).—Five exptl. batches of fire brick were made by varying the % of ganister, flint clay, and plastic clay so as to vary the  $\text{SiO}_2$  from 53 to 77%, and the  $\text{Al}_2\text{O}_3$  from 43 to 20%. The high  $\text{SiO}_2$  mixts. fused about two cones below the corresponding pure  $\text{SiO}_2$ - $\text{Al}_2\text{O}_3$  mixts. Tests at  $1350^\circ$  showed that the compression under load depended on other factors besides compn., higher burning temps. decreasing the compression. The resistance to spalling was decreased by increased burning temp.; burned below  $1400^\circ$  the bricks higher in  $\text{SiO}_2$  were more resistant to spalling, but there was no advantage with bricks burned to higher temps. J. S. LAIRD

Experiments in dead-burning dolomite and magnesite. H. G. SCHURECHT. *J. Am. Ceram. Soc.* 4, 127-51(1921).—A large number of expts. were made in attempts to dead-burn dolomite and magnesite with various fluxes, open-hearth slag, kaolin, flue dust, iron ore, and roll scale. The resistance of dolomite to slaking increased with finer grinding, varied with % fluxes, and decreased with increase in burning temp. from cone 14 to cone 26. Brick made from dolomite calcined with iron ore and bonded with tar did not disintegrate for 5-6 months. Magnesite showed decreased slaking tendency with increased burning temps. J. S. LAIRD

Experimental separation of lime in dolomite. R. T. STULL. U. S. Bur. of Mines. *J. Frank. Inst.* 190, 739(1920).—The presence of CaO in dolomite interferes with its use for the manuf. of fire-resistant brick. Treatment of a dolomite contg., after calcining, MgO 42%, CaO 58%, with running  $\text{H}_2\text{O}$  for one day increases the MgO content to 65% and allows a 50-60% recovery of CaO. Boiling the calcined dolomite in  $\text{H}_2\text{O}$  and sepg. the  $\text{Mg}(\text{OH})_2$  by flotation gives 65-75% MgO content, with 25% CaO recovery. Addition to the calcined dolomite of  $\text{H}_2\text{SO}_4$  sufficient for all the CaO, gives a 73% MgO content with 50% CaO recovery. J. S. C. I.

The effect of glaze composition on the crazing of terra cotta. E. C. HILL. *J. Am. Ceram. Soc.* 4, 25-31(1921).—With a glaze of the formula  $0.28 \text{ K}_2\text{O}$ ,  $0.21 \text{ CaO}$ ,  $0.21 \text{ ZnO}$ ,  $0.10 \text{ MgO}$ ,  $0.20 \text{ BaO}$ ,  $0.33 \text{ Al}_2\text{O}_3$ ,  $2.53 \text{ SiO}_2$ ,  $0.10 \text{ SnO}_2$  fired to cone 5 it was found that additions of feldspar or ZnO tended to decrease crazing, while additions of MgO, BaO, or CaO increased it. Increase in clay content was much more effective in decreasing crazing. J. S. LAIRD

A study of the heating and cooling curves of Japanese kaolinite. S. SATOH. *J. Am. Ceram. Soc.* 4, 182-94(1921).—Microscopic examn. showed changes at about  $600^\circ$  and at  $900$ - $1000^\circ$  where it became isotropic. It became granular at  $1250$ - $1300^\circ$  and developed sillimanite near  $1400^\circ$ . Differential heating and cooling curves were plotted with quartz sand as comparison substance. These curves showed an endother-

mic reaction from 450–700°, an exothermic near 950°, an exothermic at 1200–1300°, and other less distinct reactions. The max. rate of loss of wt. on ignition occurred at about 450°. Similar curves were plotted for  $Al_2O_3$  prepd. by igniting various salts at low temps. These showed exothermal changes near 800° and 1100°. In the discussion E. W. Washburn points out that there is an endothermal change of the quartz at 575° which has modified the author's results.

J. S. LAIRD

The effect of the replacement of free silica by alumina and zirconia in electrical porcelain. R. TWELLS, JR. AND C. C. LIN. *J. Am. Ceram. Soc.* 4, 195–205(1921).—Free  $SiO_2$  was replaced in an electrical porcelain by equal wts. of  $Al_2O_3$ ,  $ZrO_2$ , or both in a series of sixteen batches, and bars and discs after being fired at cone 8–9 or 12 were tested for shrinkage, transverse and impact strength, heat resistance, absorption, and dye penetration. Results showed that the resistance to temp. changes was increased by substituting  $ZrO_2$  or  $Al_2O_3$ , burning range lengthened by  $Al_2O_3$ , and strength increased by either, but there was no improvement in the dielectric strength.

J. S. LAIRD

A reading list on vitreous enameling on iron and steel. C. J. WEST. *J. Am. Ceram. Soc.* 4, 47–64(1921).—A list of books, articles and patents during 1907–20.

J. S. LAIRD

Cobalt (ANON.) 9.

L'annuaire des céramistes et verriers de France. 1921 Ed. Paris: J. Hogref. For review see *Rev. gen. index tech.* 28, 252(1921).

Glass manufacture; enamels; glazes. A. A. KELLY and B. D. JONES. *Brit.* 160,495, Nov. 20, 1919. In the manuf. of glass, vitreous enamels, and glazes, Na pentaborate is substituted for borax or boric acid, and the necessary adjustment of the alkali content is made in any suitable manner.

Abrasive compositions. C. W. THOMAS. *Brit.* 160,089, April 17, 1920. See U. S. 1,338,508(*C. A.* 14, 1887).

## 20—CEMENT AND OTHER BUILDING MATERIALS

C. N. WILEY

Theory of the setting and hardening of portland cement. FABIO FERRARI. *Giorn. chim. ind. applicata* 2, 620–4(1920).—A consideration of the prevailing theories upon the action of portland cement, supplemented by F.'s own expts., led him to the following conclusions. The high temp. of consolidation of portland cement, the normal presence in this of di-Ca silicate and of ternary silicates of the type  $SiO_2 \cdot Al_2O_3 \cdot 2CaO$ ;  $2SiO_2 \cdot Fe_2O_3 \cdot 2CaO$ , in which all the Fe and nearly all the Al are comprized, show that free CaO must be enumerated among the ordinary components of portland cement. The CaO (normally in solid soln. and hence slowly attackable by  $H_2O$ ) can be considered as an expansive agent only if present in excess or in such a form that it can produce, on hydrating, tensions superior to the opposed reaction forces of the cementitious mass that contains it. On this basis, setting, properly speaking, must be looked upon as due to the adhesion of the  $Ca(OH)_2$  with the hydraulically inactive elements and with the hydraulic elements not yet attacked by the  $H_2O$  during the lapsing period of time. (Free CaO gives rise to a hydrate with greater rapidity than does any other component of the portland cement in the act of mixing, and during the short period, varying from

a few min. to some hrs., that follows.) Hardening, on the same basis, must be attributed to the development of contact mutually between the hydrates and between the hydrates and the inactive components. This contact is due to the mobility which the active compds. acquire, in conformity, not only with the difference of soly. between the latter as anhydrides and as hydrates, but also because of the pressures which the free  $\text{CaO}$ , in taking on  $\text{H}_2\text{O}$ , exercez upon those hydrates, upon any anhydrous compds. and in general upon any other more or less sol. component.

ROBERT S. POSMONTIER

**Analysis of portland cement.** FABIO FERRARI. *Giorn. chim. ind. applicata* 2, 434-7(1920).—F. applies the following methods to the analysis of portland cements in order to secure great rapidity of execution without sacrifice of exactness. Coarsely powder the clinker in a steel mortar of the Abich type, then grind in an agate mortar to pass through 3600 mesh per sq. cm. Dry the substance in the air, and weigh out 3 samples, (1) for detn. of  $\text{H}_2\text{O}$ , (2) for detn. of loss on calcination, silicic acid,  $\text{Al}_2\text{O}_3$ ,  $\text{CaO}$  and  $\text{MgO}$ , (3) for detn. of insol. silicic residue,  $\text{Fe}_2\text{O}_3$  and  $\text{SO}_2$ . **Moisture.** Weigh 1 g. substance in a large Pt crucible, heat for 1 hr. at  $120^\circ$ , cool in a desiccator and weigh. **Loss on calcination.** Use an elongated crucible of 60 cc. capacity. Heat 1 g. substance in an elec. furnace for 30 min. at not less than  $950^\circ$ . **Total  $\text{SiO}_2$ .** Treat the residue from the above calcination with 4 g.  $\text{HNO}_3$  (d. 1.52), drop by drop, allowing it to run down the walls of the crucible. Keep the crucible covered as much as possible with a watch glass. On addition of  $\text{HNO}_3$  and until the whole residue is moistened, stir the substance about with a glass rod. Place the covered crucible containing the now gelatinous mass in an oven at  $100^\circ$  for 15 min. Stir the substance about from time to time with the rod. Then add 30 cc. boiling  $\text{H}_2\text{O}$  acidulated with  $\text{HNO}_3$ . Keep the mixt. at incipient boiling for 8-10 min., then filter. Wash the residue with boiling  $\text{H}_2\text{O}$  until the washings are no longer acid, using as little  $\text{H}_2\text{O}$  as possible. Dry the residue over the pump, ignite for 30 min. in the elec. furnace, and weigh.  $\text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3$ . To the filtrate from the above  $\text{SiO}_2$  detn. add 10 cc. 10%  $\text{NH}_4\text{NO}_3$  soln., heat to ebullition, and ppt. with slight excess of  $\text{NH}_4\text{OH}$  free of  $\text{CO}_2$ . Allow the ppt. to deposit, filter, wash twice with boiling  $\text{H}_2\text{O}$ . Dissolve the ppt. by dropping upon it warm dil.  $\text{HNO}_3$ , repeat the pptn. with the  $\text{NH}_4\text{OH}$ , filter and wash the ppt. completely with warm  $\text{H}_2\text{O}$  containing 1%  $\text{NH}_4\text{NO}_3$ , dry over the pump, ignite and weigh.  **$\text{CaO}$ .** Take the combined filtrates from the pptn. of the mixed oxides above, concentrate to 150 cc., heat to ebullition, and ppt. with an excess of concd. boiling soln. of  $\text{NH}_4$  oxalate. Keep at rest for 2 hrs. at about  $80^\circ$ . Filter, wash carefully with warm 1%  $\text{NH}_4\text{OH}$  oxalate soln., burn while moist and ignite with gradual increase of temp. for 30 min. over the blast. Weigh the residue as  $\text{CaO}$ .  **$\text{MgO}$ .** To the filtrate from the  $\text{CaO}$  pptn. rendered acid by  $\text{HNO}_3$ , add  $\text{Na}_2\text{HPO}_4$  in excess, bring to boiling and ppt. with 80-90 cc. 10%  $\text{NH}_4\text{OH}$ . Allow the ppt. to deposit. After the lapse of an hr., filter through a crucible of the Gooch-Neubauer type, wash with 2 1/4%  $\text{NH}_4\text{OH}$ , dry and calcine in the elec. furnace, and weigh as  $\text{Mg}_2\text{P}_2\text{O}_7$ . (In absence of such a crucible, collect the ppt. on a filter, wash completely with 2 1/4%  $\text{NH}_4\text{OH}$ , dry, transfer as much as possible of the ppt. to a weighed Pt crucible, burn the filter in a Pt spiral, transfer the ash to the same crucible. Heat at first with small flame until no more  $\text{NH}_3$  is given off, increase the heat slowly, until the ppt. is white. Weigh.) **Insol.  $\text{SiO}_2$  (Siliceous residue).** Ignite 2 g. of the substance for 15-20 min., transfer to a porcelain dish, and treat as above for total  $\text{SiO}_2$ , but using 1.19  $\text{HCl}$  in place of  $\text{HNO}_3$ . (The substitution of  $\text{HCl}$  for  $\text{HNO}_3$  is to facilitate detn. of  $\text{Fe}_2\text{O}_3$  in the filtrate as described below). Transfer the washed residue to a porcelain dish by means of boiling 3%  $\text{Na}_2\text{CO}_3$  soln. Heat with 150 cc. of this soln. at near  $100^\circ$  for 20 min. Filter, wash the residue thoroughly, first with  $\text{Na}_2\text{CO}_3$  soln., then  $\text{H}_2\text{O}$ .  **$\text{Fe}_2\text{O}_3$ .** Take half of the  $\text{HCl}$  filtrate from the above detn. of insol.  $\text{SiO}_2$ . Add 10 cc. concd.  $\text{HCl}$ , bring to 200.

cc., oxidize the Fe completely with Cl water. Cool, agitate, and add drop by drop, a cold clear 6% soln. of  $\text{NH}_4$  nitrosophenylhydroxylamine. (A) (Prepn. of A: Place 1 l.  $\text{H}_2\text{O}$  in a large vessel, add 60 g.  $\text{PhNO}_2$  and 30 g.  $\text{NH}_4\text{Cl}$ . Agitate to form an emulsion, and then while still agitating, add slowly, 1 g. at a time, 70–75 g. pure Zn in fine powder. Keep the temp. between 16–18° by addition of small pieces of ice. Reduction is complete when the odor of the  $\text{PhNO}_2$  disappears. Filter on the pump, wash the  $\text{Zn(OH)}_2$  with a little  $\text{H}_2\text{O}$ . Cool the filtrate to satn., when an abundant ppt. of  $\text{PhNH(OH)}$  forms. Dry this over the pump, then for an hr. between filter paper. Dissolve in 400–500 cc.  $\text{Et}_2\text{O}$ , filter through dry folded filter. Cool the clear soln. to 0°, pass dry  $\text{NH}_3$  through it for 10 min., then an excess (about 1 vol.) of fresh amyl nitrate. A forms at once as shining, snow white crystals. Dry, wash with  $\text{Et}_2\text{O}$ , crush between filter paper, and preserve in a hermetically closed bottle in presence of  $(\text{NH}_4)_2\text{CO}_3$ . The product is easily sol. in  $\text{H}_2\text{O}$ , the aq. soln. remaining unaltered for weeks. The soln. should always be filtered before using.) The characteristic brick-red ferric salt forms at once as ppt., pulverulent at first then uniting into easily friable large cryst. masses. Continue agitation, adding at least  $\frac{1}{4}$  excess of the reagent (0.0833 g. A are necessary for 0.01 g. Fe), when the base itself will ppt. as a voluminous white, soft, pulverulent microcryst. powder. Allow the whole to stand 15–20 min., break up the mass with a glass rod, filter and dry the ppt. over the pump with moderate aspiration. Wash twice with cold  $\text{H}_2\text{O}$  acidulated with HCl, then with  $\text{H}_2\text{O}$  alone until the washings are no longer acid. Wash repeatedly with  $\text{NH}_4\text{OH}$ , and again a few times with  $\text{H}_2\text{O}$  alone. Dry completely, bring to redness in a closed Pt crucible, then ignite in the air. Weigh as  $\text{Fe}_2\text{O}_3 \cdot \text{SO}_3$ . Take the other half of the HCl filtrate from detn. of insol.  $\text{SiO}_2$ , bring to 250 cc., heat, and ppt. with  $\text{NH}_4\text{OH}$  and  $(\text{NH}_4)_2\text{CO}_3$  in excess. Allow the ppt. to settle, filter and wash. Add a drop of methyl orange to the filtrate, neutralize with HCl, then add 1 cc. HCl (d. 1.17), and bring to boiling. While agitating, add 50 cc. boiling 2%  $\text{BaCl}_2$  soln. Allow to stand 1 hr. at 90°, filter, wash, dry a little, ignite moist in Pt crucible, weigh as  $\text{BaSO}_4$ . The above methods may be applied to the analysis of limestones, crude powders and shales. These should previously be weighed and then scorified at about 1400° (the shales first mixed with a known wt. of very pure  $\text{CaCO}_3$ ) for 30–40 min. Weigh again, powder in an agate mortar, heat, and keep in desiccator, and make the analysis on an aliquot part.

ROBERT S. POSMONTIER

**Chemical analyses of cement as indicators of behavior.** R. J. COLONY. *Eng. News-Record* 86, 736(1921).—A resumé of a paper read before the Am. Inst. of Mining and Met. Engineers. C. recommends that the results of chem. analyses of cements be calcd. to show actual components of the cements and that the values thus obtained be used as a basis for judging the quality. C. also recommends a limiting value for the ratio between the  $\text{CaO}$ , and the sum of the  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ , and  $\text{Fe}_2\text{O}_3$ . J. C. WITT

**Does hydrated lime weaken concrete?** Abrams' tests discussed pro and con. *Eng. News-Record* 85, 1296–7(1920).—A letter by L. H. HART, in which he disagrees with conclusions by A. (C. A. 14, 2895) and a letter in reply by Abrams. J. C. WITT

**What causes cement to be quick setting?** BAILEY TREMPER. *Concrete* (Cement—Mill Section) 18, 144(1921).—T. has observed that quick setting (or quick stiffening) cement is most likely to be produced when the temp. in the finishing mills is abnormally high. From expts. with gypsum and plaster of Paris, he believes that the effect is the result of dehydration of gypsum during the grinding process, when the temp. exceeds 110°. J. C. WITT

**Effect of coloring materials on the strength of mortar.** DUFF A. ABRAMS. *Eng. News-Record* 86, 721(1921).—Compression tests were made on 1–2 mortar contg. a blue

coloring material, red iron oxide up to 15% (in terms of wt. of cement), and carbon black up to 10%. The blue caused a pronounced increase in strength, the red a slight decrease, and the carbon black a material decrease. J. C. WIRT

Experimental separation of lime in dolomite (STULL) 19.

WELLER, H. O.: Sand-Lime and other Concrete Bricks. London: H. M. Stationery Office. 3d.

## 21—FUELS, GAS, TAR AND COKE

A. C. FIELDNER

Briqueted coal for household fuel. J. H. KENNEDY. Am. Briquet Co., Lykens, Pa. *J. Am. Soc. Heating and Ventilating Eng.* 27, 101-6(1921).—At this plant briquets are made from anthracite culm, a binder, the final form of which is dextrin and asphaltum, being used. It is made of water, starch and asphaltum, the mixt. contg. 79% H<sub>2</sub>O. The briquet contains 8% binder, 92% culm from which the H<sub>2</sub>O is driven off to about 1 1/4% by means of hot air. The heating changes the moist starch to dextrin. H. C. HAMILTON

Fuel loss in the briqueting of brown coal. BERNER, Magdeburg. *Chem. Ztg.* 45, 333-5(1921).—In detg. the fuel loss in the manuf. of briquets, the usual procedure, which takes into account only the fuel used in the process and the heat values of the raw coal and briquets, gives an incomplete and false idea of the actual loss. To illustrate B. calcs. the apparent and actual losses for briquets from raw coals of 45 and 60% H<sub>2</sub>O. In the case of the coal with 45% H<sub>2</sub>O against the 17.2% of coal used in making the briquets is credited the following savings: Excess power from steam made in drying the coal 1.0%, in transportation of smaller wt. 1.4%, in firing with less moisture 5.8%, in heat losses in firing 1.1%; total saving 9.3%. Actual loss in making briquets, 17.2-9.3=7.9%. For a raw coal with 60% H<sub>2</sub>O the corresponding figures are, 31.0-(8.0+2.7+9.9+2.1)=8.3% actual loss. In addition no numerical value is given for the higher efficiency of the briquet fire. Details of calcs. and a discussion of the items are given. J. J. MORGAN

Composition and formation of "oil-coal" (cylinder carbon). J. MARCUSSON. *Brennstoff Chem.* 2, 103-4(1921); cf. *C. A.* 15, 715, 1071.—The "carbon" deposit in low temp. cylinders such as those of gas compressors are distinguished from those in explosion engine cylinders. The former contain asphaltenes and asphaltogenic acids, together with metal soaps, while the latter contain carbenes, carboids, oxidized acids, etc. The "tar number" (50-hr. heating at 120°) of the lubricating oil is stated to be an important factor in C formation, 0.2 being the normal limit of this number. S or SO<sub>2</sub> in the gas supplying combustion engines increases carbon formation; Fe appears to be catalytically active in the same direction, while Al is inactive. W. B. V.

The use of pulverized coal under stationary boilers. ED. LIÉVENIE. *Age de fer* 37, 833-6(1921).—Notes on the machinery and equipment required, the early troubles encountered in its application, the advantages of the system, and the method of operation. A. P. C.

Analysis of lignites of the Venetian Prealps. CARLO GRIMALDI. *Giorn. chim. ind. applicata* 2, 255-8(1920).—A table is given of analytical data on 26 samples of lignite from mines of the Venetian Prealps, examd. during the war. The data given comprize moisture, ash, volatile substances, fixed C, thermal value. R. S. P.

**Determination of the heat of gasification of coals in the calorimeter.** H. STRACHE AND HERBERT GRAU. *Brennstoff Chem.* 2, 97-9(1921); cf. *C. A.* 14, 3518; 15, 2171.—A brief introduction by S. followed by G's report of the exptl. detn. of the "upper" heat of gasification of various fuels, i. e., "that quantity of heat, on the basis of fluid water and fluid tar at 0°, which is either absorbed or liberated in the chem. processes of gasification, increased by the heat equiv. of energy necessary to perform the external work of gas-evolution." The fuel sample was contained in a copper capsule and was heated in a constantan-wound quartz tube suspended in a Berthelot-Mahler type bomb in an atm. of N. A measured energy input raised the internal temp. to 700° in about 10 min., the current was then interrupted and the net energy received by the calorimeter bath detd. Individual detns. gave values with an av. deviation from the mean of 20-30 Cal., so from three to ten runs were made with each fuel. The av. values of the "upper" heat of gasification of the fuels, on dry, ash-free basis, were as follows: coal 1, -9 Cal.; coal 2, -9; brown coal 1, +80; brown coal 2, +104; lignite, +210; birch sawdust, +270; and cellulose, +263. The results show a fairly concordant rise with the % O in the original material. W. B. V.

**New process of distilling anthracite.** D. MENEGHINI. *Giorn. chim. ind. applicata* 2, 391-6(1920).—Review. ROBERT S. POSMONTIER

**Theoretical considerations on the subject of the composition of the gases of combustion and the gasification of coal.** J. SEIGLE. *Rev. metal.* 18, 81-91(1921).—Stoichiometric calcs. on the compn. of the gaseous products of combustion. The formula is developed,  $100/Aa + 0.5d + 1.5e + f = 100$ , where  $A = \% N_2$  in the dry entering gas,  $a = \% N_2$  in the moist gaseous product,  $d = \% CO$  in the moist gaseous product,  $e = \% H_2$  in the moist gaseous product and  $f = \% \text{ water vapor}$  in the product. Examples are given showing the application of this formula to (1) complete combustion by dry gas, (2) gasification by air more or less charged with  $O_2$  or  $CO_2$ , and water vapor. Similar calcs. are made for blast furnaces and for elec. furnaces. E. H. DARBY

**The influence of moisture in the fuel on gas producer performance.** HERMANN KOSCHMIEDER. Berlin-Friedenau. *Brennstoff Chem.* 2, 117-21(1921).—The undesirable features of using moist fuels in gas producers are illustrated by calcs. made on results of a test with lignite contg. 50-55%  $H_2O$ . The upper section of the producer becomes a dryer, more sensible heat is required in the gas leaving the middle zone, and more diluent vapor must be added in the lower zone. In many cases it is more economical to dry the fuel partly before charging it into the producer. K. regrets that published data on producer tests so rarely include the following important terms: moisture and ash content and heat value of the fuel, CO and  $N_2$  content of the gas and its heat value, and quantity of cooling diluent used. W. B. V.

**The surface combustion of gases and its application.** G. B. BONO. *Ann. chim. sci. ind.* 37, 3-14(1921).—A big metallic or other surface has a catalytic influence on the combustion of gases, especially if first treated with  $H_2$ . B. describes combustion expts. with  $H_2$  and CO and  $CH_4$ . The surface takes part in the chem. reaction, as demonstrated with a Ag-wire as catalyst for the oxidation of  $H_2$ . A review is given of the application of that principle in the chem. industry, which allows a more economical combustion. EUGENE FIERTZ

**Water determination in tar.** P. K. BREUER. *Brennstoff Chem.* 2, 125-6(1921).—Criticism of a method proposed as official by the Gas Inst., of Karlsruhe. Beck's anthracene method (*C. A.* 4, 158) is advanced as preferable. W. B. V.

**The valuation of tar acids.** "META." *Chem. Trade J.* 68, 375(1921).—Water in medium quantities (0.5-1.0%) in high grade cresylic acids is best estd. by shaking 25 cc. of the acid with an equal vol. of satd. NaCl soln. in a buret graduated to 0.1 cc.; the in-



creased vol. of the brine represents the  $H_2O$  in the acid. Small amts. can be detd. by distg., say, 500 cc., collecting the first 50 cc. of distillate, and proceeding as above. To test qualitatively for  $H_2O$ , dissolve a sample in 2 or 3 vols. of olive oil; only a dry sample dissolves without turbidity. To det.  $H_2O$  in crude acids, add about 20 cc. xylene or solvent naphtha to 100 cc. of the acid, distil into a graduate until the  $H_2O$  layer ceases to increase; this method gives results 0.3–0.5% low. Neutral oils, naphthalene, etc., in large amts. may be estd. by shaking 50 cc. of the oil with 200 cc. NaOH (20% Tw) and noting the vol. of sepd. oils. A better method consists in neutralizing 10–20 g. of the oil with 5 parts of the NaOH soln., extg. with pet. ether, evapg. the ether layer, and weighing the residue. Another method, by which the bases present may also be estd., consists in steam-distg. 25–50 g. of the oil, neutralized as above, until the distillate is entirely clear. The distillate is caught in about 20 cc. of standard 0.1 N acid. After the distn. is complete, methyl orange is added and the distillate titrated; 1 cc. of acid neutralized by the distillate = 0.0079 g. bases (calcd. as pyridine). Pet. ether is then added and the neutral oils are detd. gravimetrically as above. D. W. M.

**By-product coke ovens and their relation to our fuel supply.** E. B. ELLIOTT. *Semett Solvay Co., Syracuse, N. Y. J. Am. Soc. Heating Ventilating Eng.* 27, 381–400(1921).—The diminishing supply of fuel suggests a greater use of the by-product ovens as the major method for fuel conservation. The process may soon be applicable to all bituminous coals and thus will eliminate the bee-hive ovens and increase ammonia for fertilizer and gas for heating. Increased production of benzene from coke oven gas will make possible its use with alc. as a motor fuel and conserve petroleum supplies. The use of the tar for roofing and creosote oil as wood preservative conserves the forest supplies, while changes in furnace design will increase the use of coke as fuel for domestic heating. When properly burned coke is more efficient (61.6 against 51.9) than anthracite. The author gives a detailed account of by-product coking operations. H. C. HAMILTON

**Two modifications of the aluminium low-temperature coking apparatus.** BÄRENFÄNGER. *Brennstoff Chem.* 2, 106(1921); cf. *C. A.* 14, 3149.—A metal cooler is connected to the exit opening of the app. and the cover-plug is provided with a metal inlet tube reaching nearly to the bottom of the vessel, so as to permit distn. in a current of steam or inert gas. W. B. V.

---

Helium-bearing natural gas (ROGERS) 8.

---

COOPER, G. STANLEY: **By-Product Coking.** 2nd Ed. revized and enlarged by Ernest M. Meyers. London: Benn Brothers, Ltd. 208 pp. 13/3.

FINDLEY, A. E. and WIGGINGTON, R.: **Practical Chemistry of Coal.** London: Benn Brothers, Ltd. 144 pp. 11/3.

The "Gas World" Year Book and Directory. A Complete Directory and Handbook of the Gas Industry. Published annually in December. London: Benn Brothers, Ltd. about 230 pp. 8s. 6d.

HOLE, WALTER: **Distribution of Gas.** 4th Ed. revized and enlarged. London: Benn Brothers, Ltd.

MEADE, ALWYNE: **Modern Gasworks Practice.** 2nd Ed. revized and enlarged. London: Benn Brothers, Ltd. £2 2s.

MOORE, HAROLD: **Liquid Fuels for Internal Combustion Engines.** A Practical Treatise for Engineers and Chemists. 2nd Ed. revized and enlarged. London: Crosby, Lockwood and Son. 208 pp. 15s. net.

**The Winning, Preparation and Use of Peat in Ireland.** London: H. M. Stationery Office. 3s. net.

**Fuel.** J. H. HISLOP. Brit. 160,083, March 16, 1920. Dead leaves, wood in the form of chips or sawdust, or other combustible vegetable substances, such as bracken, peat, heather, etc., are soaked in any inflammable oil or spirit; sand may be added to the vegetable material. The mixt. is preferably briquetted. Finally, the fuel is coated with pitch or tar, to which sand has been added. The amts. of the various materials may be 15 parts of pitch or tar, 65 parts of wood, vegetable matter, etc., 10 parts of oil or spirit, and 10 parts of sand.

**Fuel.** L. W. BATES. Brit. 160,754, Dec. 29, 1920. In the prepn. of a mobile fuel consisting of up to 65% of coal dust or other carbonaceous particles more or less stabilized in liquid hydrocarbon, the coal is freed from ash and other impurities by froth flotation. A suitable construction is specified.

**Fuel.** A. A. DALE. Brit. 160,279, Dec. 18, 1919. Coal dust, coke, etc., are mixed with CaO or other alk.-earth oxide, the mixt. is allowed to stand, say, for a week, out of contact with atmospheric and other CO<sub>2</sub>, and then briquetted. The process of allowing the mixt. to stand may be effected in a sealed vessel, in which a vacuum is created during the whole or part of the standing period. In the process of mixing, hot H<sub>2</sub>O may be used and the mixt. may be heated also by means of steam; the amt. of H<sub>2</sub>O used in mixing the ingredients of the fuel may be 2.5-3 vol. of H<sub>2</sub>O to 1 vol. of the ingredients.

**Fuel.** J. W. LEADBEATER. Brit. 160,042, Jan. 17, 1920. Peat from the black or lower strata of the bog is finely disintegrated by any ordinary machinery and thoroughly mixed with ground CaO or Ca(OH)<sub>2</sub> or one or more alkalis having similar properties; the peat may be used in its ordinary undried state or H<sub>2</sub>O may be added to it. The mixt. of peat and lime is then mixed with fine ground pitch or tar or with both and with an oil, such as tar oil, mineral oil, or fuel oil or a mixt. of such oils. Finally, small or finely ground coal is added. The proportions of the materials used may be 168 lb. of peat, 4 lb. of lime, 8 lb. of pitch or tar or both, 2-3 lb. of coal, and 10% of oil. Cf. C. A. 15, 1069.

**Peat fuel.** S. C. DAVIDSON. Brit. 159,996, Dec. 11, 1919. A fuel for use in obtaining producer or other gas for power purposes is manufd. by mixing wet peat from the bog with powdered dry peat and slaked lime, separately or as a mixt., so as to obtain a consistent mass which is pressed in molds to form briquets. The powdered dry peat can be prepd. by passing common air-dried peat through a power-driven centrifugally acting disintegrating machine, or a crusher or grinding mill.

**Artificial fuel; fertilizers.** E. LLOYD. Brit. 160,620, Oct. 14, 1920. Briquets, ovoids, or other forms of artificial fuel are molded from a mixt. of about 66 $\frac{1}{4}$  parts by vol. of carbonaceous material, such as coal, peat, sawdust, and coke dust, 6 $\frac{3}{4}$  parts of coal tar, 6 $\frac{3}{4}$  parts of petroleum, 6 $\frac{3}{4}$  parts of common clay, 6 $\frac{3}{4}$  parts of lime, and 6 $\frac{3}{4}$  parts of common salt. Peat and coal, when employed, are crushed. When peat alone is used as the carbonaceous material, the fuel burns and leaves no cinders but a fine ash suitable for fertilizer.

**Storing acetylene, etc., under pressure.** SVENSKA AKTIEBOLAGET GASACCUMULATOR. Brit. 160,168, Feb. 10, 1921. C<sub>2</sub>H<sub>2</sub> or other explosive gas is stored in containers filled with granular or fibrous material in loose form, such as charcoal, silk, asbestos, or kapok, mixed with a finely divided and preferably fireproof material such as kieselguhr, which fills the interstices.

**Purifying blast-furnace and like gases.** HALBERGER-HUTTE Gds. Brit. 160,758, Jan. 26, 1921. The inflammable dust contained in blast-furnace and like gases is oxidized by the admission of a small quantity of air to the gas before purification. The control of the air supply can be coördinated with the gas generation in order to prevent the formation of an explosive mixt., by closing the air-inlet valve when the main gas valve or the blast valve or damper is closed, or by mounting the air supply fan on the shaft of the gas exhauster. Indicating or registering means may be provided for the air supply.

**Gas-mantles.** SOUTH METROPOLITAN GAS CO. and C. J. D. GAIR. Brit. 160,040, Jan. 15, 1920. A thoria mantle contains 0.2-0.4% of ceria. The provisional specification also states that the proportion of ceria may be between 0.2-0.5%.

## 22—PETROLEUM, ASPHALT AND WOOD PRODUCTS

F. M. ROGERS

**The iodine number of mineral products.** E. BÖRNSTEIN. *Brennstoff Chem.* 2, 124-5(1921).—See Röderer (*C. A.* 15, 308) and Grün and Ulbrich (*C. A.* 15, 746). W. B. V.

**The occurrence of German oil-shales.** P. K. BREUER. *Brennstoff Chem.* 2, 106-7 (1921).—A review of the distribution and bitumen content of workable deposits of oil-shale in Germany. W. B. V.

**Notes on oil shales of southwestern Wyoming.** E. F. SCHRAMM. *Bull. Am. Assoc. Petrol. Geol.* 4, 195-208(1920).—Most oil-producing shales of Wyoming are confined to Green River formation. Formation has max. thickness of about 1300 feet. The shales vary in color from gray argillaceous shales to a very black variety. Black shales produce 50 to 60 or more gals. of oil per t. Shale producing 90 gals. of oil per t. can be used directly as fuel. One section examd. contained 36 oil shale members varying in thickness from 6 inches to 68 feet and in oil content from lean to 65 gals. per t. of shale. The ash, gals. of oil per t.,  $(\text{NH}_4)_2\text{SO}_4$ , and gravity of 131 samples of oil shale from S. W. Wyoming were detd. by methods as outlined in *U. S. Geol. Survey Bull.* 641 F. R. T. GOODWIN

**Contribution to the investigation and examination of birch tar oils, and other kinds of wood tars.** J. PRITZKER and R. JUNGKUNZ. Basel. *Schweiz. Apoth. Ztg.* 59, 145-51, 162-6(1921).—Definitions and sources of these products are confused in the literature. Their compn. varies with the wood used and the method of distn. Wood from needled trees contains more resins than that from leafy trees; tar from the latter contains more creosote than from the former. Needle wood tars have chiefly diatomic phenols and their derivs. (guaiaicol and homologs); beech and aspen tars, di- and tri-atomic phenols (guaiaicol and pyrogallol); birch tar, mono- and di-atomic phenols. The materials available were studied by the aid of a table given by Hirschsohn (*Pharm. Z. für Russland* 1877, 213); the results were uncertain. As more fundamental methods for the differentiation of these substances are suggested the detn. of  $n$  and the use of the Storch test for resins. A genuine Russian leather fat had saponifiable matter 81%, acid number 136, sapon. number 149.0,  $n$  of sample 50.9,  $n$  of saponifiable portion about 46. It was a resin-free, gray-brown solid, m.  $41^\circ$ , which gave 2% on steam distn. Leather oil I, a dark brown, resin-free liquid, sp. gr. 0.897, had saponifiable matter 45%, acid number 32, sapon. number 82.24,  $n$  of original sample 63.6,  $n$  of saponifiable portion 57,  $n$  of unsaponifiable portion 62.2, and gave 2% on steam distn. Leather oil II, sp. gr. 0.918, a black, resin-free liquid, giving 2% on steam distn., had saponifiable matter 31%, acid number 13, sapon. num-

ber 52.34,  $n$  of original sample over 100,  $n$  of saponifiable portion 61,  $n$  of unsaponifiable matter over 100. Birch tar oil, sp. gr. 0.900, a black, viscous resin-free liquid had saponifiable matter 12%, acid number 30,  $n$  of original sample 86. Oleum rusci, a black viscous liquid, sp. gr. 1.120, 100% saponifiable, had acid number 180,  $n$  not determinable, and contained resin. A dark brown viscous birch tar oil, yielding 10% on steam distn., had 68% saponifiable matter, acid number 139.5,  $n$  of original sample, saponifiable and unsaponifiable portions all above 100, and contained 55% resin. A resin oil gave 8% oil on steam distn., which gave a strong Storch reaction and had  $n$  over 100 in a Zeiss butter refractometer. An addition method was devised to enable such high refractive indices to be detd. by the instrument. For resin oil it was calcd. as 152–154.

F. F. HEYROTH

**Report on the wood distillation plant of Bernardo Fuchs, El Tio, Córdoba, Argentine**

Rep. ANON. *Informes dept. investigaciones ind. Univ. Tucumán*, 6, 1–10(1918).—

A description of a small plant utilizing the waste from the manuf. of wood paving blocks. Refined products are made.

L. E. GILSON

---

Catalytic reactions; cracking hydrocarbons (Brit. pat. 160,466) 13.

---

ESSICH, O. A.: *Die Olfeuerungstechnik*. 2nd Ed. revized and enlarged. Berlin: Jul. Springer. 110 pp. M. 20.

---

**Treating petroleum oils containing olefins.** E. C. R. MARKS. Brit. 160,185, April 22, 1919. Petroleum products containing olefins, particularly the distillates obtained from cracking processes such as the Burton process, are treated with  $H_2SO_4$  of 1.57–1.84 sp. gr. at a temp. below  $30^\circ$  and preferably at  $10$ – $20^\circ$  to obtain an acid liquor containing alkyl sulfates. The acid may be added gradually or may be sprayed into the oil. The oil may be treated with successive batches of acid or an app. to which the acid and oil flow in counter-current may be used. The mixt. may be cooled. The acid liquor is sepd. by settling or centrifuging and when mixed with  $H_2O$  or other hydrolyzing agent and distd. yields monohydric *alcohols*, chiefly secondary alcohols. The oily liquid that seps. on admixt. of the acid liquor with  $H_2O$ , and which consists mainly of olefins, may be dissolved in  $H_2SO_4$ . The alcohols may be purified from olefins by soln. in  $H_2O$  or in  $H_2SO_4$  of 1.57 sp. gr. The acid liquor may be treated with organic acids or salts such as Ca acetate, and the mixt. distd. to obtain *esters*. Gasolines which contain diolefins and like unsatd. hydrocarbons are subjected to a preliminary treatment with concd.  $H_2SO_4$ , the temp. being allowed to rise, and the acid tar, or sludge formed by the treatment being removed. Cf. 13,441, 1913 (C. A. 8, 3856) 115,014, and 119,441.

**Treating wood, etc.** RUTGERS-WERKE-ART-GES. and H. TRICHMANN. Brit. 160,466, March 4, 1921. Wood, peat, brown coal, cellulose, paper, wool, horn, and other substances of organic structure are heated with tar oils to between  $100^\circ$  and  $300^\circ$  in closed vessels to dissolve 90% of the wood, etc., and form a tar oil soln. which may be distd. for recovering HOAc, MeOH acetone and creosote. Inert gases such as  $CO_2$  and N or gases such as H or water gas may be injected into the mixt. The tar oil soln. may be dild. with fresh tar oil to facilitate filtration. The residue consists, when a high temp. is employed, of finely divided C but a residue resembling pitch may be obtained having no uncombined C which may be used for impregnating wood or making briquets. Alkalies or alk. earths may be added to combine with any acids, or acid may be added to combine with any  $NH_3$  formed.

## 23—CELLULOSE AND PAPER

A. D. LITTLE

The solubility of cellulose in (solutions of) the salts of the alkali and alkaline earth metals. R. O. HERZOG AND F. BECK. *Z. physiol. Chem.* 111, 287-32(1920).—The soly. of cellulose in the concd. solns. of the above salts is a function of the hydration of the ions of the respective salts. J. C. S.

Tropical fibers for paper manufacture. A. C. HEINY. *Paper* 28, No. 8, 24-5, 41(1921).—A decorticating machine has been operated in the tropics which seps. the paper-making fiber sufficiently for economic pulping by the usual processes. Plants of the banana family and the "vegetable silk" of the pineapple family are specifically mentioned. H. H. HARRISON

A fabrikoid apron for the paper machine. ANON. *Paper* 28, No. 9, 18, 19(1921).—Fabrikoid has been found very satisfactory for use as a paper machine apron. H. H. HARRISON

The effect of variables on bleaching efficiency. GEORGE K. SPENCE. *Paper Ind.* 3, 135-7(1921); *Paper* 28, No. 7, 148, 162(1921); *Paper Trade J.* 72, No. 16, 257-9(1921).—A tabulation of expts. showing that increasing the consistency in bleaching improves the color and shortens the bleaching time. Increasing the bleaching temp. to 120° F. improves the color and shortens the bleaching time while an increase of temp. much beyond this point will shorten the bleaching time, but lower the color. H. H. HARRISON

Bleached esparto pulp. E. ARNOULD. *Rev. Univ. Papeterie* 4, 15-8(April 1921).—Notes on the nature, qualities, and use of bleached esparto pulp. A. P. -C.

A simple moisture content indicator for paper. C. B. THWING. *Paper Ind.* 3, 121-3(1921); *Paper* 28, No. 10, 16-7(1921).—Description of an instrument showing moisture content of paper and of the new Elmendorf tearing tester. H. H. HARRISON

The forest products laboratories of Canada. A. R. R. JONES. *Pulp Paper Mag. Can.* 19, 535-6(1921).—Equipment and new personnel of the Forest Products Labs. of Canada are given. H. H. HARRISON

Determining moisture content of wood (ANON.) 7. Determination of sulfur dioxide and sulfur trioxide in sulfur burner gases (DIECKMANN) 7.

Brusewitz Nordisk Papperskalender 1921. Göteborg: Hugo Brusewitz A.-B. 302 pp. 18 Kr. For review see *Papier-Ztg* 46, 1924(1921).

Plastic masses; cellulose acetate. H. DREYFUS. *Brit.* 160,225, Dec. 3, 1919. In the manuf. of plastic celluloid-like masses having a basis of cellulose acetate, the latter with or without other usual or suitable ingredients is mixed with a suitable high-boiling solvent or plastifier and with a volatile liquid or diluent having no solvent action on the acetate and in quantity sufficient to inhibit the gelatinizing action of the plastifier and to allow the mass to be kneaded without difficulty and in such a manner as easily to distribute the plastifier homogeneously throughout the mass; after kneading or incorporation, the volatile diluent is evapd. or expelled, when the plastifier proceeds to act on the acetate and eventually to give the desired celluloid-like mass which may be worked up to celluloid, etc., or may be dild. to give solns. of any desired fluidity. Suitable plastifiers are the alkylated sulfonamides referred to in 132,283 (C. A. 14, 346), 133,353, and 154,334 (C. A. 15, 1075); and the most suitable volatile

diluents are EtOH or MeOH or mixts. thereof; but if the presence of moisture is to be avoided, then benzene or other volatile liquid free from  $H_2O$  may be employed, in which case the acetate is before use also preferably freed from all moisture.

**Cellulose; resins.** C. GLAESSEN. Brit. 160,482, Oct. 17, 1919. Cellulose is obtained from wood, wood waste, paper waste, grass, etc., with the simultaneous production of artificial resin, lac, asphalt, etc., by heating with phenols or with substances of a phenol-like character in the presence of a small proportion of a catalyst such as HCl. The raw cellulose, *e. g.*, in the form of small pieces of wood, is heated with molten phenol, with or without a diluent such as  $H_2O$ , alc., or benzene, and when sufficiently opened up, the cellulose is sepd., excess of phenol recovered from the sepd. liquid, and the resin or lac finally isolated. The product obtained is a substitute for natural resins, pitch, asphalt, and lac, and may be used in the prepn. of marine glue, sealing wax, varnishes, and size.

## 24—EXPLOSIVES AND EXPLOSIONS

CHARLES E. MUNROE

Report of chief inspector, bureau for safe transportation of explosives and other dangerous articles. B. W. DUNN. Mar. 1, 1921. 75 pp. Cf. C. A. 14, 1756; 15, 756.—The number of accidents from these substances in railroad transportation during 1920 was 1777, causing 3 deaths, 86 injuries and a loss of \$1,090,806. The number of accidents was the greatest since these repts. began in 1910 but the number killed and the monetary loss the least since 1914. The largest number of accidents was from acids and corrosive liquids, the largest loss, \$595,705, from inflammable liquids. A comparison of total production in tons with loss per ton in value is begun and the data for 1918, '19 and '20 are given for black powder, high explosives, charcoal, gasoline, matches and  $HNO_3$  as representing the most dangerous articles. The average for the 3 yrs. of loss per ton is  $HNO_3$  \$2,297, matches 0.5373, gunpowder 0.143, charcoal 0.0657, gasoline 0.0537 and high explosives 0.0112. The figs. for all explosives in the table are for normal production. If, in 1918, the war production were included, the total would be about 1,000,000 tons and the loss \$0.026 per ton. During 1920 much attention has been given to the acid carboy test and a committee, representing makers of acid, makers of carboys and the Bur. of Explosives is engaged in standardizing the dropping test and pendulum impact test. The heaviest loss from tank cars is chargeable to the bottom outlet valve. One prolific source of leakage has been disposed of in the prohibition of extensions and supplementary valves extending below the level of the outlet valve cap. Leakage of HCl from wooden tanks has led to formation of a committee of acid shippers with the Bur. of Explosives to experiment with glass and rubber linings for both steel and wood tanks and to obtain a standard HCl car. Experience with poisonous liquids and gases and other poisonous articles necessitated a revision of freight and express regulations including shipping-container specifications. A tabular list of fires and losses from matches shows that (1) fiberboard containers are supplementing wooden ones; (2) in proportion to vol. of shipments in fiberboard these cause more fires and greater total losses; (3) the loss per fire is less for fiberboard packages as they are more nearly air-tight than wooden containers and this tends to smother a fire. The report of CHARLES P. BRISTLE, chief chemist, gives statistics of investigation of action of mixed acids on steel and finds that, to prevent excessive corrosion of tank cars, steel drums or similar shipping containers, mixts. of  $H_2SO_4$  +  $HNO_3$  should contain not less than 10% of  $H_2SO_4$ . Investigations of fires from pulverized coal or foundry facings developed a coal from Colorado so active that it ignited spontaneously in lots as small as 100 lbs. It carried an exceptionally high percentage of volatile

org. matter. *Peanut skins or bran*, consisting of the membrane coating the meat of the nut, having caused fires investigation showed this due to impregnation with natural oil from the meat and it is proposed that peanut bran contg. more than 12% of oil shall be a prohibited article in the revised regulations. *Varnished paper* is found to cause fires unless shipped in long and tightly rolled strips. It, and varnished cloth, are frequently cut in small pieces such as disks, gaskets or washers and these heat. *Sulfur chloride* although shipped in steel containers was found rapidly to corrode steel especially with increased temp.  $P_2O_5$  was found to heat up by contact with moisture sufficiently to cause ignition of adjacent combustible material. The coefficient of expansion was detd. for 9 vegetable and animal oils commonly occurring in commerce and it was concluded that there should be an outage of approx. 2% in shipping containers. *Sodium picramate* contg. 15.5%  $H_2O$  was readily ignited by spark or flame but was only ignited and not detonated by a No. 6 elec. detonator. At a temp. of 295-300° it exploded with considerable violence. After 72 hrs. at 75° it gave no evidence of decompn. It is considered unsafe for transportation unless contg. 20% of water. The rept. of the Test and Specification Dept. by G. E. Carleton is of value to chemists.

CHARLES E. MUNROE

**A recently developed dust explosion and fire hazard.** DAVID J. PRICE AND HYLTON R. BROWN. U. S. Dept. of Agri., *Circ.* 171, 7 pp.(1921).—This deals with explosions of dust-air mixts. ignited by incandescent elec. lamps, either from the dust accumulated on the bulb becoming heated to incandescence or from dust clouds becoming ignited when the bulb of a glowing incandescent elec. lamp was broken. A description, with drawings, of the method devised for testing the latter is given and explosions of dust-air were obtained with both vacuum and gas-filled lamps, except vacuum tungsten and carbon lamps of very low wattage. *All elec. lamps in places where inflammable and combustible dust exist should be equipped with vapor-proof globes, protected by heavy guards to prevent breakage.*

CHARLES E. MUNROE

**The preparation and properties of 1,3,5-trinitrobenzene.** L. GUY RADCLIFFE AND ALAN A. POLLITT. *J. Soc. Chem. Ind.* 40, 45-8T(1921).—A 71% yield of 1,3,5- $C_6H_2(NO_2)_3$ , m. 121°, was obtained when 50 g. of  $m$ - $C_6H_4(NO_2)_2$  was gently heated for 3 hrs. at 110° with 75 g. of 100%  $HNO_3$  and 125 g. of oleum containing 60%  $SO_3$  and the product again heated for 6.5 hrs. at 110-120° with 35 g. of 100%  $HNO_3$  and 50 g. of oleum (60%  $SO_3$ ). In several instances a product, m. 61°, was obtained but the precise conditions necessary to the production of this compd. were not ascertained. Both compds. formed with  $PhNH_2$  an addition compd., m. 124°, and on regeneration by  $HCl$  both gave the 1,3,5- $C_6H_2(NO_2)_3$ , m. 121°. From the depression of the f.p. in  $C_6H_6$  by Sidgwick's method, it appears that the two *s*-trinitrobenzenes are polymorphic, that one melting at 61° being the less stable.

CHARLES E. MUNROE

**The preparation and properties of 1,3,5-trinitrobenzene.** L. G. RADCLIFFE AND A. A. POLLITT. *J. Soc. Chem. Ind.* 40, 90T(1921).—Discussing the paper by R. and P. (preceding abstract), W. H. Gibson doubts the existence of a less stable form of *s*-trinitrobenzene, m. 61°, since it not infrequently occurs in the trinitration of  $C_6H_6$  that a mixt. of di- and tri-nitrobenzenes is obtained, not easily sepd. by crystn. and melting near 60°. Radcliffe replied that fractional crystn. using different solvents failed to sep. other crystals or to change the m. p. (61°), and that several different methods gave results for N pointing to a trinitrobenzene.

CHARLES E. MUNROE

**The stability of benzoyl peroxide.** ROBERT CROSDIE FARMER. *J. Soc. Chem. Ind.* 40, 84-6T(1921).—Benzoyl peroxide is best made by the action of  $Na_2O$  on  $C_6H_5COCl$ . On crystn. from alc. a pure product m. 103-104° is obtained. Using F.'s vacuum app. for test of stability by velocity of evolution of gas at chosen temps. (*C. A.* 15, 753), while picric acid and TNT yielded none at 100° and tetryl gave only 0.06 cc. per g.

in 100 hrs., at 49° ( $C_6H_5CO$ )<sub>2</sub>O<sub>2</sub> gave 0.93 cc. per g. in 100 hrs., at 80° it gave 7.45 cc. in 24 hrs. and at 100° it exploded within 30 min. When exposed at ordinary temp. in a vacuum desiccator over H<sub>2</sub>SO<sub>4</sub>, crude benzoyl peroxide exploded after 8 hrs. There is evolved on decompn. CO<sub>2</sub>; approx. 1 mol. to 1 mol. of benzoyl peroxide, accompanied by the odor of phenyl benzoate. This tendency to explode in the dry state applies to both crude and pure material. The peroxide may be rendered immune against explosion by admixt. when wet with excess of NaCl and then drying. Benzoyl peroxide for use in low-tension elec. detonators is covered by Eng. Pat. 23,450 of 1912.

CHARLES E. MUNROE

**Recovery of sulfuric and nitric acids from acids used in the manufacture of explosives.** Technical Records of Explosives Supply, 1915–1918, No. 1. H. M. Stationery Office, London 1920, 56 pp., 24 plates. 12s. 6d.—There have been 4 reports previously published by the Brit. Dept. of Explosives Supply under the direction of Mr. W. Macnab in an endeavor to place on permanent record the valuable results obtained in operation of the National Factories during the war and in the research divisions attached to them. They are "Report on costs and efficiencies for H. M. Factories controlled by Factories Branch, Dept. of Explosives Supply" now out of print, "Second report" on the same, costing 7s. 6d. "Report on the statistical work of the Factories Branch," costing 4s. 6d., and "Preliminary studies for H. M. Factory, Gretna, and study for an installation of phosgene manufacture," costing 15s. This last was reviewed in *C. A.* 15, 1813. The book now under consideration is the first of a series of special reports and it is divided into Section I "Description of the process" covering (a) denitration and (b) absorption, and Section II "Plant design and operation." The spent acids dealt with vary depending on the explosive that had been manufd. and the methods of treatment for recovery therefore vary, spent acids from nitrocellulose manuf. being denitrated by distn. in "stills," while those from nitroglycerin and TNT manuf. are denitrated by steam in columns or "denitrators." Only the second method is described in this publication. As most of the investigations were carried out in connection with denitration of TNT spent acids the emphasis is placed on this and a full description of a standard plant given, reference however being made to deviations from such practice at other factories as well as the more important developments thus brought about. Section I contains an admirable presentation of the process by the aid of chem. and mathematical formulas and tabulated data, while the graphic presentation of the "Distribution of nitrogen in the various plants of the factory," in Section II, is of special interest.

CHARLES E. MUNROE

**Testing explosives force with the piezometer.** ANON. *Sci. Am. Monthly* 3, 337–8 (1921).—Describes Thomson's method and gives much interesting information regarding hemi-hedral crystals, including NaKC<sub>4</sub>H<sub>4</sub>O<sub>4</sub>, used in wireless operations, together with formula for detg. the *piezo electric const.* (*Cf. C. A.* 13, 1638, 1786, 3057.)

CHARLES E. MUNROE

**Blasting with liquid oxygen.** S. P. CORTLAND. *Sci. Am. Monthly* 3, 333–6 (1921).—A general review of development with statistics of use is given and dependence on portable liquefying app. is shown. *Cf. C. A.* 14, 1757, 2264, 3795. C. E. M.

**Determination of mineral oil in solenite.** R. MORETTI AND M. TALIANI. *Giorn. chim. ind. applicata* 2, 433–4 (1920).—Solenite is an explosive used in the recent war of the following compn.: 61% tri + dinitrocellulose (% N = 12.5–12.7); 36% nitroglycerin, 3% mineral oil. To det. the mineral oil in solenite proceed as follows: Boil the sample for a long time with 10% NaOH soln., then ext. several times with Et<sub>2</sub>O, distil the latter off, weighing the residue from the extrn. ROBERT S. POSMONTIER

**The behavior of explosive gas mixtures under reduced pressure. Part II.** A. STRA-



VENHAGEN AND E. SCHUCHARD. *Z. angew. Chem.* 34, Aufsatzteil 114-5(1921); cf. *C. A.* 15, 1076.—The expts. with H + O mixt. were repeated in 4 eudiometers having diams. of 8, 12, 25 and 12 mm., the critical ignition pressures found being 50, 40, 15 and 30 mm. of HG, resp. The results obtained are shown by graphs. CHARLES E. MUNROE

**An explosion of hard rubber dust.** DAVID J. PRICE AND HYLTON R. BROWN. *Chem. Met. Eng.* 24, 737-40(1921).—Although not heretofore considered as such, hard rubber dust is combustible and forms explosive mixts. with air. This accident, through which 8 were killed, 1 was injured and property valued at \$25,000 destroyed, occurred in the course of reduction of hard rubber to dust by grinding for reuse. The circumstances and precise cause of the accident were not definitely detd., but a set of recommendations covering possible causes is offered. CHARLES E. MUNROE

**An interesting fire in a laboratory.** T. HOWARD BUTLER. *J. Soc. Chem. Ind.* 40, 83-4R(1921).—About 0.75 gals. of creosote was being heated in a cylindrical Fe still for the removal of H<sub>2</sub>O, some 200 cc. of heavy naphtha having been previously added to facilitate the distn., which had been carried out with a ring burner placed about 3 in. above the bottom of the still. Apparently all the H<sub>2</sub>O and naphtha had been removed, as the temp. of the vapor at the top was 210° and "sweating" had been going on in the still for approx. an hr., when, with a hissing noise like a roaring wind, the still "bolted over." The large room was at once filled with a thick black cloud, the Pb covering of a table melted, paint blistered, notebooks and papers charred, but a bottle of Et<sub>2</sub>O, two yds. away, remained intact. As the gas supply was controlled by a cock outside, the building, the burner flame was at once cut off. It is believed this accident would not have occurred if the still had been heated at the bottom. It is advised that a ring burner be not used without bottom heating and that the ring burner be rapidly lowered to near the bottom of the still when there are indications that all the H<sub>2</sub>O has been distd. over. CHARLES E. MUNROE

**Industrial explosion hazards.** Gases, vapors, flammable liquids and dusts. W. D. KEEFER. *Safe Practices* 34, 12 pp.(1920).—This is one of a series of Safe Practice pamphlets issued by the National Safety Council of Chicago. It gives definitions of explosion and classifies the dusts, liquids and gases that may form explosives mixts. It considers the methods of ignition by oxidation, flame, sparks, heat, and lightning with precautionary measures to be taken. In the case of liquids, details for shipping containers, storage tanks, special storage houses, pipe lines and dip tanks are given, while under "dusts" building design and plant cleanliness are given special consideration. Com. explosives are discussed in Safe Practices pamphlet No. 28. CHARLES E. MUNROE

**The manufacture of dynamite and gelatin.** E. M. SYMMES. *Hercules Powder Co.* 16 pp. 12 X 19.5 cm.(1919).—An admirable non-technical description of these arts illustrated by attractive photographs and explanatory diagrams. C. E. M.

**Coal-dust hazards in industrial plants.** L. D. TRACY. *Bur. Mines, Repts. Investigations* 2242, 6 pp.(1921).—Conditions of danger from spontaneous ignition and from opening conduits for pulverized coal before all pressure on them is released are pointed out. A graph for the rate of oxidation of Ill. coal (ground to 80-100 mesh) at various temps. from 104-392° F. shows that at about 150° F. the rate of oxidation is very rapid (cf. *C. A.* 14, 1222). CHARLES E. MUNROE

**The relative safety of brass, copper and steel gauzes in miner's safety lamps.** I. C. ILSLEY AND A. B. HOOKER. *Bur. Mines, Tech. Paper* 228, 39 pp.(1921).—Characteristics of gauzes, on which their use in safety lamps depend, are melting point, relative thermal cond., sp. heat and tendency to oxidation. Other variables remaining constant, safety with any gauze decreases with increase in the velocity of the air mixt.

From the tests of various types of lamps it was found that for high temps. steel was superior to brass or Cu, but that for low temps. it had little advantage. The tests showed that double-gauze bonneted lamps are the safest, and single-gauze unbbonneted lamps of the Davy type should not be classified as safety lamps. The results proved that the gauze specifications of Bur. of Mines Schedule 7 rests on a sound foundation. Tests of monel and Ni gauze are proposed.

CHARLES E. MUNROE

**Picric acid as a blasting agent.** CHARLES E. MUNROE AND SPENCER P. HOWELL. Bur. Mines, *Repts. Investigations* 2243, 15 pp.(1921).—Upwards of 25,000,000 lbs. of surplus military TNT having now been successfully expended principally on governmental engineering projects but to some extent in clearing cut-over lands (C. A. 14, 1897), investigations are now under way for the safe utilization in domestic land-clearing operations of some 11,000,000 lbs. surplus picric acid to be distributed by the U. S. Dept. of Agriculture. The field study of safe conditions is being carried out coöperatively by the Bureaus of Mines and of Public Roads and the College of Agriculture of the Univ. of Wisconsin. This bulletin was written as a guide in this study and, besides giving the results of various tests at the Pittsburgh Expt. Station, it reviews the characteristics of picric acid and presents tentative instructions. The chief apprehension rests on the tendency of moist picric acid to form sensitive picrates, hence for the present "dry picric acid" means picric acid containing not more than 0.2% of water. It is probable that this limit may be raised as a result of the field study.

CHARLES E. MUNROE

**Technical Records of Explosives Supply 1915-18. No. 1. Denitration of Spent Acids.** London: H. M. Stationery Office. 12s. 6d.

## 25—DYES AND TEXTILE CHEMISTRY

L. A. OLNEY

**Literature of coal tar products, dyestuff manufacture and dye application.** J. A. WILSON. *Textile Colorist* 43, 327-8(1921).—A short bibliography of French and German literature.

CHAS. E. MULLIN

**Experiments on after-treatment of sulfur-dyed cotton.** A. S. EICHLIN. *Textile Colorist* 42, 777-8(1920).—The results are given of 8 expts. on after-treatment with  $\text{CuSO}_4$  and  $\text{AcOH}$ , made to ascertain some idea as to the mechanism of the reaction and conditions for max. and minimum fixation of Cu. The amt. of Cu fixed appears to vary widely.

CHAS. E. MULLIN

**After-treatment of sulfur-dyed yarn with copper sulfate and acetic acid.** ARTHUR S. EICHLIN. *Textile Colorist* 43, 323-4(1921); cf. preceding abstr.—Although this treatment dulls the shade of many S colors and makes the goods harsh, it in many cases increases fastness to light. The results of 45 tests of the after-treatment upon 44 dyes from 9 sources are given.

CHAS. E. MULLIN

**Dyeing and printing of cotton dress-goods.** WILHELM ALBERT. *Deut. Färb.-Ztg.* 57, 407-9, 430(1921).—The various processes of preparing, dyeing or printing, and finishing the goods are described with minute detail.

L. W. RIGGS

**Oxidation by a mixture of chlorate and an alkaline aldehyde-bisulfite combination under the action of steaming.** ARTHUR PELLIZZA. Sealed note No. 1469, May 6, 1904. *Bull. soc. ind. Mulhouse* 86, 640-1(1920).—Chlorates in the presence of alk. bisulfites are reduced to Cl oxides or free Cl at cold temps. with violence. If in place of the free bisulfite an acetone or aldehyde bisulfite is used, the reaction takes place

at about 100° and its velocity may be regulated to some extent by the presence of small amts. of certain salts. Thus  $\text{KClO}_3 + (\text{CH}_3)_2\text{COHSO}_3\text{Na} + \text{salt of an aromatic amine}$ , steamed for a few min. develops aniline black. The fiber is not attacked more than with the ordinary ferrocyanide-chlorate method. **Report on Sealed Note No. 1469 of Arthur Pellizza.** ANTOINE LIPP. *Ibid* 641.—The reactions indicated by Pellizza's note take place. The mixt. serves as an oxidant for the aniline black dyes and in the oxidizing discharge of the chlorate. In the latter case the white obtained is not as pure as that with ordinary colors by chlorate-prussiate and tartaric acid. L. W. RIGGS

**Colored discharges of formaldehyde-sulfoxylate with basic dyes on azo foundation.** JUSTIN-MUELLER. Sealed note No. 1931, Dec. 15, 1909. *Bull. soc. ind. Mulhouse* 86, 636-7(1920).—This note refers to No. 1686 on the same subject, deposited Dec. 18, 1906 and opened Oct. 30, 1907. The blue N soln. contains new methylene blue N 40 g., glycerol 80 cc., water 750, roasted starch 400 g. For the discharge on zinc-prussiate use blue N 1 liter, white discharge with hyalidite C extra 1/s 2 one liter,  $\text{ZnSO}_4$  50 g. For the tannin-emetic discharge use the same except replace the  $\text{ZnSO}_4$  by 50 g. of 1 to 1 tannin-glycerol. **Report on Sealed Note No. 1931 of Justin-Mueller.** CHARLES SUNDER. *Ibid* 637-9.—The priority of the method is conceded. The Zn-prussiate discharge gives brighter and more solid colors than the tannin-emetic discharge.

L. W. RIGGS

**From the notebook of a practical dyer of artificial flowers and millinery goods.** J. H. HALLIDAY. *Textile Colorist* 42, 531(1920).—Brief directions for dyeing horse hair, grass, seeds, covered wire, rice, etc., with aq. or alc. solns. of acid and basic dyes. Shellac is added to the alc. dye soln. in some instances. CHAS. E. MULLIN

**Control of chlorine in the bleaching of cotton goods.** C. M. EDWARD SCHROEDER. *Met. Chem. Eng.* 24, 925-6(1921).—The method of making bleach from liquid Cl and soda ash or waste caustic soda liquors recovered from mercerizing, is described and contrasted with the former process in which chloride of lime was used. The installation and use of the Wallace and Tiernan Cl control equipment is explained, showing a decided saving in labor and chemicals. L. W. RIGGS

**Influence of the various operations of chlorination on the copper index of cottons.** H. BRAIDY. *Rev. gén. mat. color.* 25, 35-42(1921).—Cotton treated with chloride of lime is partly converted to oxycellulose which reduces Cu solns. The number of mg. of Cu pptd. as  $\text{Cu}_2\text{O}$  by 1 g. of cotton is called the Cu index for cotton and varies with the degree of oxidation produced in the cellulose by the action of the chloride of lime. For the detn. of the Cu index 2 solns. are used, (a)  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  50 g.,  $\text{H}_2\text{O}$  up to 1 liter; (b)  $\text{NaHCO}_3$  50 g.,  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$  350,  $\text{H}_2\text{O}$  up to 1 liter. Five cc. of (a) are mixed with 95 cc. of (b) at the time of making the test. The mixt. is heated to boiling and poured on 2.5 g. of the cotton sample in an Erlenmeyer flask, which is covered with a watch glass and allowed to remain in a steam bath for 3 hrs. The unchanged Cu soln. is sepd. from the cotton and  $\text{Cu}_2\text{O}$  which are rapidly washed with boiling water containing a little  $\text{Na}_2\text{CO}_3$ , and left suspended in 50 cc. recently boiled water until cold, when 5 cc. of a soln. containing  $\text{Fe}_2(\text{SO}_4)_3$  50 g.,  $\text{H}_2\text{SO}_4$  250, and  $\text{H}_2\text{O}$  up to 1 liter are added and the  $\text{FeSO}_4$  formed by the action of  $\text{Cu}_2\text{O}$ , is titrated with  $\text{KMnO}_4$  containing 1.25 g. in 1 liter. Each cc. of the permanganate corresponds to 0.0025 g. of Cu. Details are given for treating the cotton sample with chloride of lime before detg. the Cu index. Chlorinations in an alk. medium, in media acid by  $\text{HCl}$ ,  $\text{H}_2\text{SO}_4$  and  $\text{H}_3\text{BO}_3$ , resp., are described, also the effects of time, concn., temp., and light. Results are shown in tables and 7 charts of curves. In order to utilize to best advantage the chloride of lime, it is recommended to chlorinate in an acid medium to produce  $\text{HClO}$ . In carbonated solns.  $\text{NaHCO}_3$  is used notwithstanding its cost. To avoid iteration of the fiber the conditions should be regulated so as not to exceed a Cu index

of 0.4 to 0.6. Heat should not be applied. Much space is given to theoretical discussions of the reactions involved.

L. W. RIGGS

**Applications of maleic and fumaric acids and their salts in the textile industry.** J. H. CARPENTER. *J. Ind. Eng. Chem.* **13**, 410-3(1921).—For bottom-chroming of wool both maleic and fumaric acids and their salts give uniformly good fulling, rubbing, washing and light-fastness tests, as compared with the results obtained with the important lactic and tartaric acid compds. so extensively used for this purpose. The action of maleic acid most closely resembles that of lactic and tartaric acids; the action of Na acid maleate closely resembles that of cream of tartar; and the action of fumaric acid most closely resembles that of  $H_2SO_4$  and AcOH. The best comparative results were obtained with the dye Anthracene Blue S. W. G. G. For the top-chroming process, both maleic and fumaric acids successfully replace larger percentages of AcOH. For the meta-chroming process neither of these acids can be substituted successfully for twice as much AcOH, although their  $NH_4$  salts might be more valuable for meta-chroming shoddy. Neither of the acids is a satisfactory substitute for  $ACONH_4$ , but their  $NH_4$  salts liberate  $NH_3$  when heated, and the acids, not being volatile, remain in the dye bath. For wool printing, maleic acid is as good as tartaric acid. For dyeing silks with acid colors either acid can be used successfully and gives bright colors. For discharging in cotton printing, maleic acid is a good substitute for tartaric acid when used for certain colors, and for oxalic acid when used for discharging indigo. The problem of applying these acids and their salts to the textile industry is still in its infancy and there is much work to be done before any comprehensive report can be submitted.

L. W. RIGGS

**The waterproofing of cotton fabrics.** A. J. HALL. *Textile Colorist* **43**, 325-7(1921).—Some details are given of the Al soap process with analytical control methods for the Al liquors, and testing the finished fabric.

CHAS. E. MULLIN

Serecin and the estimation of its constituents (TÜRK) 11A. Scouring and leather-dressing compositions (Brit. pat. 160,738) 29.

FIERZ, HANS EDWARD: **The Fundamental Processes of Dye Chemistry.** Frederick A. Mason, translator. London: Messrs. J. and A. Churchill. 21s. This is a correction of title. That given in C. A. 15, 1222, was taken from a source which had it incorrectly.

**Impregnating fabrics.** E. NAEFE. Brit. 160,039, Jan. 15, 1920. Woolen fabrics are protected against moths by impregnation with solus. first of a salt of alginic acid or of tannin, and then of an Sb salt, so that an insol. Sb compd. is formed in the fabric.

**Fireproofing, waterproofing, and metallizing lace, etc.** A. NORWEB. Brit. 160,627, Jan. 30, 1920. Lace and other fabrics, etc., are fireproofed, waterproofed, and metallized by immersion in an emulsion prepd. by mixing an aq. soln. of  $Na_2B_4O_7$  and  $Na_2SiO_3$ , a soln. of rubber in naphtha and amyl acetate, and metal powder.

## 26—PAINTS, VARNISHES AND RESINS

A. H. SABIN

**Protection of iron with paint against atmospheric corrosion.** J. NEWTON FRIEND. *J. Iron and Steel Inst.* Advance copy No. 5, 4 pp.(1921); cf. C. A. 13, 1156.—The method consisted in exposing to the atm., for a period of 5 years, series of plates of steel coated with various paint mixts., and detg. their loss in wt. due to corrosion. Polymerized

linseed or litho oils were found superior to raw oil. Ordinary boiled oils will not as a rule offer as good protection to Fe as the raw oil. It was demonstrated that not only do 2 coats of paint protect Fe from atmospheric corrosion more efficiently than by 1 coat, thinner than the two together but they are even slightly more efficient than 1 coat containing the same wt. of paint as the 2 together. This applies only to atmospheric corrosion. A precisely opposite effect is obtained by prolonged immersion of Fe plates in  $H_2O$ .  
V. O. HOMERBERG

**The coumarone resins.** ERICH GLASER. Vienna. *Brennstoff Chem.* 2, 99-102, 113-7(1921).—The paper opens with a critical review of com. methods of coumarone resin prepn. from tar distillates, and a paragraph listing the properties and uses of the technical products. The action of  $H_2SO_4$  on the  $C_8H_8$  homologs, the higher olefins, naphthenes, cyclopentadiene, styrene and tar oils leads in general to undesirable products, the real parent substances for the valuable resins being indene and coumarone. The constituent of the finished resin which possesses the most desirable characteristics seems to be the  $Me_2CO$ -sol.,  $Et_2O$ - $EtOH$ -insol. fraction, which in some cases amounts to 50-60%. The  $Me_2CO$ -insol. fraction is chiefly a dark acid resin, usually contaminated with  $Na_2SO_4$ . The  $Et_2O$ - $EtOH$ -sol. fraction is regarded as a mixt. of low-melting para-indene and para-coumarone, together with styrene condensation products of oily nature. The yield of a resin of good quality is about 0.2% of the wt. of crude tar commercially; by careful fractionation and washing the yield can be raised to 0.24%. Conditions necessary to obtain a hard, bright-colored product, are as follows: (1) the quantity of washing-acid must be carefully regulated and an excess avoided, (2) the washing-acid must be carefully sepd. from the naphtha, (3) the after-washing must be very thorough, (4) the tar-oil fraction b. 160-200° alone should be used, (5) superheating during distn. must be avoided, as by steam distg. G. suggests that the high-boiling phenols of low-temp. tar ("T-Teer") can be converted by cracking to a mixt. of coumarone, lower phenols and lower aromatic hydrocarbons, the first two classes having an assured outlet in the artificial resin industries.  
W. B. V.

---

Composition of linseed (FAGAN) 11D. Cellulose; resins (Brit. pat. 160,482) 23.

---

COFFIGNIER, CH.: *Les vernis*. Preface by M. Haller. Paris: J.-B. Baillière. 640 pp. For review see *Rev. ing. index tech.* 28, 251(1921).

---

**Resins.** H. J. POOLEY and J. L. STREVS. Brit. 160,080, March 12, 1920. The gum or resin is extd. from the outer part of grass trees (*Xanthorrhoea*) by the use of an alc. solvent prepd. from the inner core of the tree. The latter is disintegrated, mashed with  $H_2O$ , filtered, fermented, and finally rectified to a minimum strength of 70% alc. The outer part of the tree is then treated with this solvent either by immersion or percolation, and the gum is recovered from the resulting soln. by distn., preferably under reduced pressure. The purified gum can be used for the manuf. of varnishes and lacquers. The exhausted residues can be used directly as briqueted fuel or treated for paper pulp production either alone or in conjunction with the residual fiber from the treatment of the inner core of the tree.

**Synthetic resins.** VICKERS, LTD., JOCO RUBBER AND WATERPROOFING CO., LTD. and W. H. NUTTALL. Brit. 160,258, Dec. 15, 1919. In the condensation of phenols with aldehydes the catalyst employed is a salt or double compd. of  $(CH_3)_3N$ , or mixts. of these, employed in such proportions that the quantity of  $(CH_3)_3N$  does not exceed 2% by wt. of the reacting ingredients. Numerous examples are cited.

**Synthetic resins.** BARRETT CO. Brit. 160,148, Sept. 7, 1920. A light-colored

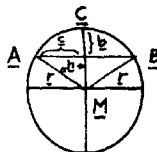
resin of high m. p. is obtained by treating solvent naphtha contg. coumarone, indene, etc., with a polymerizing agent ( $H_2SO_4$ ,  $AlCl_3$ , etc.) at temps. below  $20^\circ$ . The naphtha may be preliminarily treated with a dild.  $H_2SO_4$  to remove impurities. The treated naphtha contg. the resin in soln. is neutralized, washed, distd., and steam-distd.

## 28—SUGAR, STARCH AND GUMS

F. W. ZERBAN

**Inversion of sugar solutions.** THEODOR GAGELL. *Z. Ver. deut. Zuckerind.* 1919, 380; *Z. Zuckerind. tchecoslov. Rep.* 44, 128(1920).—G. studied the behavior of sugar during inversion on a large scale. The solns. were  $75^\circ$  Brix and were inverted at  $95^\circ$  with technical HCl. The mass was constantly stirred during the inversion. Solns. made from cryst. sugar inverted readily. Solns. obtained from domestic heavy raw juices required 4-5 times the amt. of HCl and more time for inversion. Solns. prepd. from foreign raw sugar required such amts. of HCl as to correspond to the ratio of ash to HCl as stated by Herzfeld, i. e., 1:0.7. Numerous tables are given. J. M. K.

**Dilution of after-product sugar liquors with water.** THEODOR GAGELL. *Z. Ver. deut. Zuckerind.* 1919, 391; *Z. Zuckerind. tchecoslov. Rep.* 44, 96(1919).—In order to facilitate the centrifuging of the after-product liquors these are dild. with light gravity molasses or with water. Analysis shows that water can be added with advantage to the fillmass without great danger of increasing the purity of the resulting molasses. The water is added to the masseculite under mixing until it is "short" and the crystals begin to sep. from the mother liquor. Analytical data are given in tabular form obtained during expts. in which different amts. of water were added to the after-product liquors before centrifuging. G. gives the following method for calcg. the vol. of liquor in cylindrical mixers: If  $r$  = radius,  $l$  = length of the mixer, then its total vol. =  $\pi r^2 l$ . The empty space is represented by  $ABCA$ . Then  $s = \sqrt{r^2 - (r-b)^2}$  and  $ABM = (r-b) \times \sqrt{r^2 - (r-b)^2}$ ;  $\cos n^\circ = (r-b)/r$ ;  $AMBCA = \frac{r^2 \pi \cdot 2n^\circ}{360^\circ}$ . Then the vol. of the liquor in the mixer equals,  $s \times \{r^2 \pi - [(r^2 \pi \cdot 2n^\circ / 360^\circ) - (r-b) \times \sqrt{r^2 - (r-b)^2}]\}$



JOHN M. KRNO

**New tables for the determination of the sugar content and purity of sugar juices.** G. GLASER. *Oesterr. Z. Zuckerind.* 11, 1918; *Z. Zuckerind. tchecoslov. Rep.* 44, 301 (1920).—The tables are based on a new method of detn. G. applies the "volumetric polarization" method used for juices up to  $26^\circ$  Brix, to the heavier juices. 25 cc. of the juice in question is taken, diluted to 100 cc. and polarized. The tables give the sugar content and purity for the various degrees Balling and the polarization of the juice obtained as described above.

JOHN M. KRNO

**The extension of "volume polarization" as proposed by G. Glaser.** G. BRUHNS. *Centr. Zuckerind.* 28, 544-6(1920).—Criticizes the attempt of Glaser (cf. preceding abstract) to apply the method of vol. polarization to juices having a sugar content in excess of  $26\%$ . There is no gain in rapidity and a possible loss in accuracy in using the method.

JOHN M. KRNO

**The substitution of ammonium molybdate for  $\alpha$ -naphthol as an indicator of small amounts of sugar in boiler water.** G. DOREMÜLLER. *Deut. Zuckerind.* 1919, 574; *Z. Zuckerind. tchecoslov. Rep.* 44, 116(1920).—Ammonium molybdate as an indicator of small amts. of sugar in water intended for the boiler house was found to be satisfactory. To 0.5 cc. of the water to be tested, 10 drops of a  $25\%$  HCl soln. and 20 drops of a  $10\%$

ammonium-molybdate soln. are added. The mixt. is brought to a boil. If sugar is present a blue color develops on standing.

JOHN M. KRNO

**The absorption of iodine by starch.** H. VON EULER AND KARL MYRBÄCK. *Arkiv Kemi, Mineral. Geol.* 8, No. 9, 29 pp.(1921).—The time of cooking materially affects the amt. of I taken up by a starch from benzene soln. Thus a 2.52% soln. of Lintner's sol. starch cooked 1 min. absorbed 0.0576 g. I per g. starch, but when cooked 45 min. it absorbed only 0.0177 g. I. A 0.86% soln. of potato starch cooked 45 min. absorbed 0.584 g. I. Cooking beyond about 30 min. has little further effect, although on very long cooking the I adsorption increases a little. It is still uncertain whether this heating effect is due to increase of surface or to dehydration. By increasing the concn. of I in the benzene it was found that the absorption of I up to a certain partial pressure (about 3% I in the benzene) is 7.4% and then rises rather sharply to about double (13.5%). The authors believe this indicates the formation of 2 definite chem. compds.,  $[C_6H_{10}O_5]_{11}I_2 = 8\% I$ , and  $[C_6H_{10}O_5]_{11}I_4 = 14.9\% I$ , which are stable at a certain I dissociation pressure, and that the absorption of I by sol. starch is not to be considered as a case of adsorption or of soln. of I in starch. An appendix gives some observations on the hydrolysis of starch.

JEROME ALEXANDER

**The physical properties of the gum of *Prunus pennsylvanica*.** CLAUDE H. HALL, JR. *Bull. Maryland Acad. Sci.* 1, 19(1921).—The pale yellow transparent gum of *Prunus pennsylvanica* (cf. U. S. Dispensatory, 20th ed., 4) shows no definite structure under the microscope even when stained with eosin. Its  $d_{15}$  is 1.465. A residue of carbon and ash is left when it is heated to  $150^\circ$  in air, but when heated in a sealed tube, an oily liquid distills into the cool end. The gum is slightly sol. in AcOH but insol. in EtOH, MeOH, CS<sub>2</sub>, ether, CHCl<sub>3</sub>, CCl<sub>4</sub>, glycerol, and acetone. It forms a colloidal soln. which will not settle and can be filtered but from which the gum may be removed by centrifuging. The max. concn. at  $20^\circ$  is 20 g. per l. A sol which contained 17.5 g. per l. had the following properties: sp. gr., 0.959; abs. viscosity, 0.0631; surface tension by the drop number method, 68.4 dynes per sq. cm.; and  $n_{D1000} = 1.42$ , all at  $18^\circ$ .

WM. STERICKER

**Karaya gum preparations.** H. V. DUNHAM. *Brit.* 160,045, Jan. 20, 1920. Dry. water-sol. products are prepd. from Karaya gum by dissolving the gum in H<sub>2</sub>O containing a non-oxidizing alk. substance, e. g., NaHCO<sub>3</sub>, and evapg. the resulting soln. Prior to evapn., another alkali-sol. material may be added, e. g., rosin, or casein either *per se* or as milk, a milk product, or artificial milk. The products are useful as thickening agents in cloth-finishing or in the prepn. of calcimine or distemper paints; in the manuf. of sizing compns.; or for making food preps. such as bread, cake, ice-cream, or confectionery.

## 29—LEATHER AND GLUE

ALLEN ROGERS

**Some notes on the filtration of tanning solutions.** J. GORDON PARKER AND J. T. TERRELL. *J. Soc. Leather Traders' Chem.* 5, 112-5(1921).—Expts. are described showing the superiority of filter candle (Berkefeld) to filter paper in detn. of sol. matter in tanning exts. Filter paper absorbs considerable sol. matter even if as much as 200 cc. is rejected before evapn. to dryness.

JEROME ALEXANDER

**A note on the yield of extract from tanning material.** A. HARVEY. *J. Soc. Leather Trades' Chem.* 5, 115-17(1921).—In figuring ext. yield from tanning materials it is an error to ignore the decrease in wt. consequent upon loss of sol. matter, which may run as high as 20% and is only partly accounted for by sludge formation during cooling.

In one case being investigated there was very considerable loss with but slight sludge formation.

JEROME ALEXANDER

The "modified shaking method" in the analysis of tanning materials. G. BALDRACCO AND S. CAMILLA. *Giorn. chim. ind. applicata* 2, 499-504(1920).—Reply to correspondence of J. Gordon Parker (*C. A.* 14, 1060), in reference to the "modified shaking method" proposed by the authors, as substitute for the "official shaking method." The authors make the following conclusions from their further expts.: (1) The official method for the detn. of non-tannins, in some cases of analysis of exts. and tanning substances, is not free from errors, because the powder of lightly chromed skin which is prepd. according to that method, cannot retain the whole of the tannins. (2) The filtrate of non-tannins, obtained in following out the official method, results, in some anomalous cases, in containing tannins, which are not revealed by the usual chlorated gelatin reaction, but may be detected by the acetic gelatin reagent. (3) The "modified" method avoids anomalous cases of analysis because it employs a properly prepd. and kept lightly chromed powder, and therefore gives a filtrate always free of tannins and giving negative reaction with the acetic-gelatin reagent; it has, moreover, the advantage of being easier and affording more certain execution, saving time and tedious manipulations.

ROBERT S. POSMONTIER

Tannin content of some Hokkaido materials. LLOYD BALDERSTON. *J. Coll. Agr. Hokkaido Imp. Univ.* 10, Pt. 2, 29-35(1921).—The analyses are given of 28 barks and woods of trees native to Hokkaido. The important materials are the barks of the following trees: *Salix purpurea*, tannin 7.49%; *Salix caprea*, 8.23%; *Taxus cuspidata*, 9.59%; *Picea jessoensis*, 9.03%; *Picea glehnii*, 19.21%; *Rosa rugosa*, 23.52%; *Quercus dentata*, 11.28%; *Quercus grosseserrata*, 9.21%, and *Larix leptolepis*, 8.47%. I. D. C.

Reply to R. Lauffmann's paper on the shaking method and the filtration method. G. BALDRACCO AND S. CAMILLA. *Collegium* 1921, 125-7; cf. *C. A.* 14, 1460.—The filtration method for detn. of tans should be discarded in favor of the more accurate shaking method.

JEROME ALEXANDER

Remarks on one bath chrome tanning. E. GRILICHES. *Collegium* 1921, 127-9; cf. *C. A.* 14, 3819.—Reply to criticism of E. Stiasny.

JEROME ALEXANDER

Synthetic tanning agents. C. IMMERHEISER. *Collegium* 1921, 130-2.—Reply to objections raised by W. Moeller to synthetic tanning agents. The N found by Moeller in the tanning baths does not represent dissolved hide substance but is present originally in the Ordoval.

JEROME ALEXANDER

Determination and behavior of free sulfuric acid in leather and the animal skin. C. IMMERHEISER. *Collegium* 1921, 132-5; cf. *C. A.* 15, 449.—Reply to W. Moeller's criticism of the ether-sulfuric acid method.

JEROME ALEXANDER

Remarks on Moeller's paper "The relation between hydrolysis and adsorption." V. KUBELKA. *Collegium* 1921, 135-41.—Reply to criticisms of W. Moeller (*C. A.* 15, 1638).

JEROME ALEXANDER

Tannin of oak bark. K. FEIST AND R. SCHÖN. *Arch. Pharm.* 258, 317-18(1920); *J. Chem. Soc.* 120, 1, 117.—The tannin has been extd. from oak bark in a purer form than heretofore by applying a process previously described (Feist and Haun, *C. A.* 7, 2869). Contrary to earlier statements (Etti, *Monatsh.* 4, 512), it contains no  $\text{CH}_2\text{O}$  group, and the  $\text{CH}_2\text{O}$  compds. associated with it have no tanning properties. By means of  $\text{CH}_2\text{N}_2$ , a stable Me derivative was obtained, and found to have  $[\alpha]_D^{15} -43^\circ$ , and a mol. wt. of about 1800. No compd. could be found in the bark from which the tannin might be produced, but a prepn. of catechol (which gives the same degradation products as the tannin in question) was also found to be levorotatory. W. O. E.

Jelly value of gelatin and glue. MORITSUGU ISHIKAWA. *J. Chem. Ind. Japan* 23, 1147-52 (1920).—A new method of detg. the jelly value of gelatin and glue is given.



The method is based on the detn. of the m. p. of a definite soln. under const. conditions. Two % (by wt.) of gelatin and 5% of glue should be used. A test tube 1.2 cm. in diam. having a mark at 1 inch is taken. A beaker is provided with a thermometer and with a cover through which the test tube is inserted. The test tube is filled up to the mark with a sample to be tested and inserted into the beaker, which is then surrounded by ice during 1 hour. The beaker is then gradually heated and the temp. detd. at which the jelly melts so that its surface changes in a straight line when the tube is inclined. In the summer time, it is recommended to immerse the tube directly into ice and transfer quickly to a beaker previously cooled with ice. A more consistent result will be obtained when the detn. is repeated several times with the same soln. Various concns. of Japanese gelatin, American crystal gelatin, Huberg hide glue, English square hide glue, and Star skin gelatin were compared. Results are satisfactory.

S. T.

**Manufacture and properties of fish glue.** DONALD K. TRESSLER. Mellon Institute. *Chem. Age* (N. Y.) 29, 173-5(1921).—Fish glue is made from waste products of fish. These products are divided into (1) heads, (2) trimmings and bones, and (3) skin from dried salt fish. After the salt has been washed out, (2) and (3) are extd. with hot water until the liquor contains about 5% glue. This is drawn off and the extn. repeated. A preservative is added and the glue liquor is evapd. to 50-55% solids. An essential oil is added to mask the odor. The heads are bleached and extd. with dil. acid. The residue, "chum," contains approx. 50% protein and is sold as *chicken-feed* or as *fertilizer*. The glue is usually marketed as liquid glue since it is sol. in water at ordinary temps. The grades are (1) photo-engraving glue from first-run liquor from the skins, (2) fish-waste glue, and (3) fish-head glue. They should have a gel point of about 7.5, should not contain more than 0.2% NaCl, and should not be sticky or liquid when an  $\frac{1}{8}$  inch layer is dried at 25° with 80% humidity. Fish glues consist chiefly of proteoses and peptones with some proteins and resemble bone glues more than hide glues. Much fish glue contains a white pigment since alone it forms a dark glue line. When properly preserved, it will keep indefinitely. It is used in *photo-engraving*, and wherever flexible glue is required.

WM. STERICKER

Resistance of anthrax spores to chlorine, pickling liquors, formaldehyde and mercuric chloride (MÜLLER) 11C.

JETTMAR, JOSEF: *Moderne Gerbmethode*. 2nd Ed. completely rewritten and enlarged. Vienna and Leipzig: A Hartleben's Verlag. 264 pp. M. 24 and 20%. For review see *J. Am. Leather Chem. Assoc.* 16, 283(1921).

**Scouring and leather-dressing compositions.** A. T. HOUGH. *Brit.* 160,738, July 30, 1920. A compn. to be mixed with H<sub>2</sub>O to scour wool, and with oils to dress leather, is prepd. by mixing a neutralized sulfonated oil such as Na or NH<sub>4</sub> sulforicinate with an org. solvent, preferably non-inflammable. Solvents specified are CCl<sub>4</sub>, C<sub>2</sub>H<sub>5</sub>Cl, C<sub>6</sub>H<sub>5</sub>Cl, tetrahydronaphthalene, benzene, and naphtha. In an example, 40 parts sulforicinate are mixed with 60 parts C<sub>2</sub>H<sub>5</sub>Cl. For wool scouring, 1 part of the product is used with 10 of Na<sub>2</sub>CO<sub>3</sub>, and for dressing chrome leather 4 parts with 2 parts of neats-foot oil and 2 parts of oil.

**Depilating hides, etc.** W. RAUTENSTRAUCH. *Brit.* 160,435, Aug. 4, 1920. Hides and skins are depilated in a Ba or Sr hydroxide bath enriched with hide parings, waste, etc., or other albuminous matter, so that the albuminous matter absorbed by the hide from the bath balances or exceeds the loss of hide substance during depilation. The hydroxide is stated to prevent putrefaction of the albuminous matter. A lime bath may be similarly augmented but in this case a suitable disinfectant such as cresote is added.

